

HORTICULTURAL ABSTRACTS.

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Abstracts. Initialled abstracts in the present number are by W. A. Bane, T. N. Hoblyn, W. S. Rogers and H. M. Tydeman of the East Malling Research Station, and by H. A. A. van der Lek, of the Landbouw Hoogeschool, Wageningen.

INDEX OF CONTENTS.

HORTICULTURE—MISCELLANEOUS	.. .. .	Nos. 275-279
TREE FRUITS, DECIDUOUS	.. .. .	280-309
Breeding, Selection	.. .. .	280-289
Propagation .. .. .	.. .. .	290
Rootstocks .. .. .	.. .. .	291
Root growth .. .. .	.. .. .	292-294
Growth, Nutrition .. .. .	.. .. .	295-297
Pollination .. .. .	.. .. .	298-299
Manuring, Cultural practice	.. .. .	300-309
SMALL FRUITS, VINES	.. .. .	310-324
PLANT PROTECTION OF DECIDUOUS FRUITS	.. .. .	325-348
VEGETABLE GROWING	.. .. .	349-362
FLOWER GROWING	.. .. .	363-365
CITRUS	.. .. .	366-377
TROPICAL CROPS	.. .. .	378-412
STORAGE	.. .. .	413-419
PROCESSING, FRUIT PRODUCTS	.. .. .	420-424
NOTES ON BOOKS AND REPORTS	.. .. .	425-435

Horticultural Abstracts

Vol. III

September, 1933

No. 3

HORTICULTURE—MISCELLANEOUS.

275. YATES, F. 581.084.2 : 519

The analysis of replicated experiments when the field results are incomplete.

Emp. J. Exp. Agr., 1933, 1 : 129-42, bibl. 4.

All those who have had to analyse the results of replicated experiments, such as a system of randomized blocks or a Latin square, have experienced the difficulty of carrying out such an analysis when one or more plots (or trees) are missing.

In 1930 Miss Allan and Dr. Wishart gave a method for supplying a single missing value ; and in the present paper the method is extended to enable any number of missing values to be replaced. The solution of a complex example is effected and the validity of the subsequent analysis is shown to be little disturbed, provided the number of missing values is not too large. T.N.H.

276. WYLLIE, J. 634/635-1.16

Horticultural accounts.

J. South-Eastern Agr. Coll., Wye, 1932, No. 32, pp. 24-37.

A plea for the keeping of horticultural accounts with suggestions on alternative methods of doing so. Sample accounts are given for various branches of horticultural work, while notes on the interpretation of results show how horticultural account keeping can be turned to very good use. It is pointed out, for instance, that expenditure should be considered in relation to revenue rather than as a thing apart. It is the ultimate effects upon final results of increasing or decreasing costs per acre which are of first importance, and accounts kept on the lines laid down over a period of years would afford a very definite evidence on a still debatable subject—whether a high cost policy producing good yields of quality produce is more profitable than a low cost policy with small yields of average quality.

277. REZNIK, A. 631.61

Quelques plantes intéressantes pour la mise en valeur de terrains incultes d'après des essais effectuées dans les républiques russes. (Some plants of interest for bringing waste land into cultivation noted by Russian research.)

Rev. Bot. Appl., 1933, 13 : 201-5, bibl. 8.

Scorsonera Tau-saghiz Lipshiz and Bosse, now being investigated as a source of rubber, was collected in 1929 on the stony slopes of the Kara Tau Mountains in Central Asia at an altitude of about 4,000 ft. The soil was well aerated and was sufficiently supplied with humus. The plant appears to be variable and five different forms have been distinguished according to the proportion of latex contained in the leaves. In its habitat it flowers from May to mid-July, the seeds beginning to ripen three weeks later. The latex of the underground parts is yellowish green or white and coagulates fairly quickly. If, however, the harvest is confined to the parts

above ground, the plant will shoot again the following spring. It is both self and insect pollinated. For artificial cross pollination the flowers should be emasculated two days before opening between 5 a.m. and 9 a.m. and the pollen should be applied two days later between 8 a.m. and 10 a.m. [Prof. N. I. Vavilov, alluding to this plant (*Rev. Bot. Appl.*, 1933, 13 : 249) says that over 100 different wild forms have been found, that difficulties lie in the depth of its roots which contain most of the latex, and in its slow growth, that a special experiment station has been set aside for its cultivation. The wild population has been mapped and is estimated at 18 million plants. In 15 years Vavilov thinks it will be a serious rival to Hevea.—Ed.] The leaves of *Solidago Laevenworthii*, a plant imported from North America, contain 4% of gutta percha. In spite of this low ratio it can be profitable if grown on a large scale under Russian conditions. *Parthenium argentatum* Gray is a Mexican plant whose possibilities as a source of rubber have been extensively investigated in U.S.A. It is reported to equal the best Hevea rubber, but the results of the investigations are said to be closely guarded. Observations on plants raised in Russia have distinguished 8 different forms all capable of cropping in the districts west and east of the Caspian Sea. A certain species of *Rhus* native to the Crimea and Caucasus has been found to produce a chemically pure tannin which can be used in the preparation of gallic acid and gallocyanide, its leaves produce an essential oil used in perfumery, and the stems and roots produce a yellow dye. A saxifrage (*Badan*) from the Altai Mountains and Lake Baikal supplies 1 ton of tannin and 150 gr. of hydroquinone per hectare. A number of other plants are mentioned, but their potentialities have long been well known.

278. WELLMAN, H. R., AND OTHERS.

634.1/7

The 1933 agricultural outlook for California.

Calif. Agr. Ext. Serv. circ. 71,* 1933, pp. 93.

More than half this bulletin is devoted to a consideration of fruit production in California and the economic outlook for fruit producers. It is particularly interesting as showing from what quarters the keenest competition is to be expected, the effect of tariffs and of the fall in buying capacity of customers. The following are dealt with in some detail :—apples, apricots, cherries, grapes, peaches, pears, plums, prunes, grapefruit, lemons, oranges, almonds, walnuts, olives.

279. HUTCHINSON, H. P.

634.973.623

The preparation of "White Rods" by forcing methods. Progress report.

Long Ashton Res. Sta. Ann. Rept. for 1932, 1933, pp. 232-4, and

A preliminary investigation on the preparation of rods of *Salix purpurea* as "White".

Ibidem, pp. 235-6.

Previous attempts to get early white rods by forcing did not yield results likely to justify the practice on a commercial scale. In 1932 at Long Ashton, however, bolts of 25 varieties of willow, each containing 200-300 rods, were put in the greenhouse with their butts in water to a depth of 8 inches on January 15th. The temperature of the house ranged from 50° to 60° F. throughout the experiment and the supply of water was maintained at a constant level. The date at which the several varieties became peelable varied from February 15th to March 12th. Notes are given of the condition of the willows. Various treatments were tested for the preparation of "white rods" of *S. purpurea*, var. Dicky Meadows. The bundles were treated as described above and on April 1st the rods were found to be readily peelable. The simple procedure of removing the rods from the bundle and, after peeling, immediately immersing in tap water and allowing to remain there for 20 minutes may, it is thought, "eventually enable growers to market rods of this species as 'white' and basket makers to meet the public taste in producing small basketry in first quality 'white' as well as 'buff'."

* Contribution from the Giannini Foundation of Agricultural Economics.

The following also are noted :—

Ogilvie, L., AND HUTCHINSON, H. P. *Melampsora Amygdalinae*. The rust of basket willows (*Salix triandra*). I. Observations and experiments in 1932.

Long Ashton Res. Sta. Ann. Rept. for 1932, 1933, pp. 125-30, and

II* *Spore germination experiments*. Ibidem, pp. 131-8, bibl. 3.

TREE FRUITS, DECIDUOUS.

Breeding, Selection.

280. SPINKS, G. T. 634.1/7-1.523
Progress report on fruit breeding.

Long Ashton Res. Sta. Ann. Rept. for 1932, 1933, pp. 19-23.

Descriptions are given of certain new varieties available at Long Ashton including 6 dessert apples, 1 pear, 4 plums, 2 black currants, 1 blackberry. As regards black currants Cotswold Cross and Mendip Cross show great promise. Seedling raspberries containing Lloyd George and Improved Beehive blood are being tested. The Ashton Cross blackberry has given 50% better crops than the Himalaya, has a better flavour and is one of the least susceptible to frost of the seedling varieties. Strawberry breeding has been unsuccessful owing to cultivation failures. A new uniform system of nomenclature to be used for fruit raised at Long Ashton is explained. The varieties will be given place names usually derived from the West Midland or South-West of England, which will be followed by the word Cross, indicating that the varieties are the result of hybridization. The names of towns are to be used for apples and pears, rivers for plums, and hills for bush fruits, e.g. apple Gloucester Cross, black currant Mendip Cross.

281. THOMAS, P. H. 634.1/7
The Kettering experimental plot.
Tasmanian J. Agr., 1933, 4 : 56-60.

A small area was acquired in 1929 for the propagation and testing of new fruit and stock varieties. The soil is grey loam underlain by a friable clay subsoil. It is well sheltered and has an average rainfall of approximately 38 inches. *Pome fruits*. Layer beds of the following apple stocks imported from England are now producing yearly large numbers of rooted stocks. Nos. 1, 2, 4, 7, 9, 12, 13, 15, 16 and Seedling C. Cox's Orange Pippin, Cleopatra and Jonathan are being raised on each and in the coming winter trials will start at another centre to determine how these worked trees will behave under Tasmanian conditions especially with regard to growth, productivity and disease resistance. Among scion varieties of apple Golden Delicious, Rainier, Grimes Golden, Winter Banana, Star King and others are being tested for Tasmanian conditions. *Berry Fruits*. Of the English raspberries under trial Lloyd George was very successful and the best of four varieties tried, being disease-resistant, very vigorous and fruitful, and yielding fruits eminently suited for canning and jam making. Some seedlings of Lloyd George which show pronounced late and early fruiting characteristics are also under observation. English gooseberries being tried include Careless, Lancashire Lad, Whinham's Industry, Sir Hercules Robinson. Of black currants Goliath gives the most promise to date. Hazel nuts, represented by the *Corylus Colurna* variety, principally grown in Turkey, are being tested. Trials are also in progress on fresh strains of Tardive de Leopold, Sir Joseph Paxton, Oberschlesien and Royal Sovereign. [In view of the Bureau's forthcoming publication on strawberry "degeneration" it is interesting to note the writer's statement : " Many of the existing local strains of such varieties as Royal Sovereign appear to be deteriorating . . ."—Ed.]

* Ogilvie, L. is sole author.

282. HOWE, G. H.

634.1/8-1.523

New or noteworthy fruits, XI.*New York State Agr. Exp. Sta., Geneva, bull. 620, 1933, pp. 18.*

The breeding work at this station started 50 years ago on grapes only. Nowadays the work embraces all the more common hard fruits, small fruits and nuts. A total of 119 fruits have been described in previous bulletins. The station does not undertake the dissemination of the varieties which it recommends. Instead, fruits recommended for trial are distributed through the New York State Fruit Testing Co-operative Association, Geneva. This is a non-dividend paying, co-operative organization for testing and distributing the station's new productions. Any fruit grower in the world can belong by paying an annual fee of 1 dollar, which entitles him to purchase at cost of production the new varieties listed in the annual catalogue. Varieties described here are:—*Apples*: Kendale, an addition to the McIntosh types; *pears*: Ovid and Willard, both crosses between Bartlett and Dorsett. They both seem to possess freedom from blight; *cherries*: Early Rivers, re-introduced to American notice, and Emperor Francis; *peaches*: Oriole, said to be much superior to Elberta, and Valiant, an Elberta seedling of great promise; *grapes*: Seneca, a cross between Lignan blanc and Ontario. It shows winter hardiness; *black raspberries*: Naples, a cross between Honeysweet and Rachel; *strawberries*: Cato, especially for the home garden, and Clermont and Culver, both Marshall x Howard crosses.

283. ESELTINE, G. P. VAN.

634.12

Notes on the species of apples. I. The American crab apples.*New York Agr. Exp. Sta., Geneva, tech. bull. 208, 1933, pp. 22.*

The writer gives a synopsis of the sections and subsections of *Malus* given by Rehder in the *Journal of the Arnold Arboretum*, 12: 20, 1931. He then describes botanically with illustrations and notes on habitat the following:—*Malus platycarpa* (Georgia Crab), *M. ioensis* (Prairie C.), *M. angustifolia* (Southern C.), *M. glaucescens* (Dunbar C.), *M. glabrata* (Alabama Crab), *M. lancifolia* (Alleghany C.), *M. coronaria* (Wild sweet C.), *M. bracteata* (Missouri C.), *M. fusca* (Oregon C.). He recommends, though without stating the reason, that these species, which are mainly ornamental, should be worked on seedlings of native wild crabs, rather than on common apple stocks.

284. OTUKA, Y.

634.11

The characteristics of Manchurian apples. [In Japanese.]*South Manchuria Railway Co. Agr. Res. bull. 10, 1933, pp. 13.*

Descriptions accompanied by illustrations are given of 35 apples cultivated in South Manchuria. These are all well known varieties chiefly grown in America. The second part of the paper is concerned with the physico-chemical characters of the fruit.

285. PEARL, R. T.

634.11-1.521.3-1.547.4

The inflorescences of apple trees. II. An historical review together with further varietal descriptions.*J. South-Eastern Agr. Coll., Wye, 1933, No. 32, pp. 9-17, bibl. 12.*

The author gives further notes of his observations on apple varieties (see *J. Pom. Hort. Sci.*, 1932, 10: 19, *H.A.*, 1932, 2: 2: 107). Duhamel du Monceau (1768) was apparently the first writer to make definite use of apple inflorescences and a brief description is here given of the flowers of 22 out of the 39 varieties included in this writer's work. In the expanded edition of his *Traité des Arbres Fruitières* a larger number of varieties are described and floral descriptions usually given. Poiteau in *Pomologie Française* (1838-46) describes, but less thoroughly, the flowers of some 57 varieties. Mas, writing between 1865 and 1884, makes a great advance on previous attempts but does not use the reproductive organs of the flower in his descriptions. Lanche (1882-3) illustrated apple inflorescences of more than 100 varieties, but gave no written

description. Hatton (1919, J.R.H.S. 44: 89) gives brief floral descriptions of 8 clonal varieties of rootstock and Pearl here adds descriptions of some 15 further dessert or cooking varieties of apple grown in England. He describes the apple inflorescence and gives du Monceau's description of the individual apple flower with a translation. He then provides a most enlightening glossary of terms used in his varietal descriptions, which conclude this interesting article.

286. TUKEY, H. B. 634.23-1.523
Embryo abortion in early ripening varieties of *Prunus Avium*.
Bot. Gaz., 1933, 94 : 433-68, bibl. 22.

The frequent failure to obtain seedlings from seed of early ripening cherries has led to this critical development study of and comparison between the late ripening variety Downer and the early ripening Early Purple Guigne. The process of development for the two varieties is minutely examined and described. From the data obtained it is considered probable, but not accepted as entirely proved, that the cause is nutritional, since there was nothing structurally abnormal in the aborting embryos and these embryos given proper conditions of growth have continued to develop and have produced seedlings with true foliar leaves. [For methods of cultivation of embryos see *J. Hered.*, 1933, 24 : 7-12, *H.A.*, 1933, 3 : 2 : 147.—ED.]

287. KHOMENTOVSKY, G. I. 634.11 : 581.162.3
The germinating capacity of seeds as shown in apple hybridization experiments in the years 1925-1929. [Russian-English summary.]
Sci. Res. Inst. Southern Horticulture bull. 16a, 1932, pp. 64.

Observations on the germinating capacity of seeds obtained by cross and self pollination of different apple varieties were made between 1926 and 1930. A total of 58,991 seeds from 276 varieties were tested. The average germination for all varieties over the 5-year period was 60.8%. Seeds which were collected in unfruitful years appeared to have displayed poorer germinating capacity than those collected in fruitful years, but further evidence is necessary to confirm this. Varieties are enumerated having seeds with a high germinating capacity and it is stated that such varieties also give rise to seeds with a high germinating capacity when used as pollen parents. A germinating capacity intermediate between that of the two parents was usually obtained when varieties differing widely in this respect were crossed. The germination capacity of seeds obtained from self pollinations was not lower than that of seeds from cross pollinations. No correlation could be established between the germinating capacity of the seeds, the percentage yield of fruit obtained by hand pollination, pollen germination in a 10% sugar solution and the chromosome numbers of the varieties used. The author suggests that his study provides reason for supposing that the germination capacity of seeds is a varietal character, genetically determined, but does not consider that he has been successful in elucidating its details, even approximately.

H.M.T.

288. NEBEL, B. R. 634.11 : 576.312.32
Chromosome numbers in aneuploid apple seedlings.
New York State Agr. Exp. Sta., Geneva, tech. bull. 209, 1933, pp. 12, bibl. 10.

By crossing $2n \times 3n$, $3n \times 2n$, and $3n \times 3n$ varieties of apples aneuploid individuals exclusively were obtained which are of no practical value. The artificial production of commercial polyploid apples must therefore be attacked by other methods. Chromosome counts from 89 aneuploid seedlings bear evidence that the primary basic number in *Pomoideae* is 7. If the observed numerical values are compared with a calculated normal frequency curve deviations of the observed values occur where they would be expected in case the number 7 exerts a disturbing influence. Similar comparison for the number 8 does not meet the facts equally well. [Author's summary.]

289. BOBONE, A. DE L. A. 634.37
 Contribuição para o estudo taxonómico de espécie *Ficus Carica* L. (**Taxo-**
nomy of *Ficus Carica* L.)
Anais do Instituto Superior de Agronomia, Portugal, 1932, 5:2:124-242,
 bibl. 21.

In this classification of figs grown in Portugal reliance is placed solely on the fruit characters. Those taken into account are (1) shape; (2) colour of epidermis; (3) degree of roughness and bloom of epidermis; (4) colour of flesh; (5) consistency, taste and quality of flesh; (6) length of peduncle; (7) weight and size. Fifty-two varieties of figs are examined and described on these lines and finally classified in a simply arranged key. The methods and results of a study of the chromosomes of four varieties are described. The process of fructification from the first differentiation of the flower bud to the full maturity of the fruit is studied in the case of two varieties. The paper is illustrated by 181 photographs and drawings.

Propagation.

290. GARNER, R. J. 634.1/2-1.541.5
The use of rubber strips in budding fruit trees.
Gard. Chron., 1933, 94:13-14.

Trials to compare the relative values of rubber strips and raffia for tying buds are described. Ten plots each of 20 apple stocks, No. IX (Jaune de Metz), so disposed as to eliminate soil differences, were used for each method. All 400 trees were budded the same day by the same budder with Cox's Orange Pippin. The rubber strips were from 4 to 6 inches in length, three-sixteenths to five-sixteenths inches in width and capable of being stretched to a length of 3 feet without breaking. The cost of the strips was 5s. per thousand. The cost of 1,000 ties of raffia including pulling was 3s. 6d., but 99 raffia buds out of 200 needed re-tying owing to breakages within 21 days. The speed was about the same in both methods. The result showed a 92% success with rubber and 79% with raffia, but it is remarked that this is only a first trial, and that others are in progress. The use of rubber strips is a common practice in American horticulture. It is claimed that with these ties the danger of their constriction in the neighbourhood of the bud in the case of neglected trees and the labour of re-tying or removal of the tie are eliminated.

Rootstocks.

291. ALLAN, H. H., AND WOODHEAD, C. E. 634.11-1.541.11
Apple rootstock investigations. Work in New Zealand by the Plant Research Station.
New Zealand J. Agr., 1933, 46:256-9.

The authors give an account of investigations on the classification of the Northern Spy stock. The stocks tried, all theoretically Northern Spy, were obtained from small preliminary collections and by root cuttings from numerous orchards in all the apple growing areas of New Zealand, the persons providing the material being asked to send material from trees of (1) outstanding, (2) normal and (3) sub-normal growth. Owing to bad weather not all the stocks grew. It was possible to differentiate them into 9 distinct types, the majority conforming to what the authors designate as type I and describe as follows:—Growth strong and vigorous; leaves larger than in any other type, except type V, standing away horizontally from the stem and curving downwards at the apex. Descriptions of the other types are given and show a wide range of vigour. They have been worked on Mallard IX (Jaune de Metz) and hence should bear fruit for comparison in 3 or 4 years' time. Propagation of the types by the layering method has already been started. [If it is found that a complete range of vigour combined with woolly aphid resistance can be obtained, the work seems to open up immense possibilities. Later in the article it is stated that

"on the comparatively poor lands in parts of the Nelson apple growing area a more vigorous stock than Northern Spy is required for varieties of weaker habit". On the other hand, the work described on previous pages suggests that Northern Spy may embrace a suitable type without recourse to seedling stocks of unknown potentialities.—ED.]

Root Growth.

292. KINMAN, C. F. 634.1/2-581.144.2

A preliminary report on root growth studies with some orchard trees.

Proc. Amer. Soc. Hort. Sci., 1932, 29 : 220-24.

The author's studies on growing roots of myroblan, peach, apricot and olive trees by means of observation trenches during 1930 and 1931 at Chico, California, are described. Observations were made at approximately fortnightly intervals, through glass windows fixed in trenches at 2½ to 3 ft. from the tree trunks. A thin layer of sand filled the space between the soil and the glass. Root growth was traced with coloured wax pencils on the glass. The windows and trenches were covered with boards to exclude light and lessen temperature changes. The period of greatest root activity of peaches was about the middle of May. The myroblans were a little earlier and the apricots a little later. Practically no root growth was observed during January, and very little during June. A second period of root activity was noted from September to November. Lack of soil moisture may have caused the cessation of root growth during the dry summer. It is suggested that cutting the roots during the installation of the trenches greatly stimulated new root formation, and further it is deduced that deep cultivation may be harmful in late spring but beneficial in autumn or winter.

W.S.R.

293. ZIMMERMAN, P. W., AND OTHERS. 581.144.2 : 546.262.3

The effects of carbon monoxide on plants.

Contrib. Boyce Thompson Inst., 1933, 5 : 195-211, bibl. 7.

In a previous paper (*ibidem*, 1933, 5 : 1 and *H.A.*, 1933, 3 : 2 : 152) the author showed how the exposure of stem tissue to carbon monoxide had in numerous cases induced or stimulated root growth. It was found that leafy tomato cuttings so exposed rooted better than those without leaves. The indication was that light was an important factor. Later tests of exposing such cuttings to the gas both in complete darkness and in daylight resulted in the production of numerous adventitious roots along the stem under the latter conditions only, none being produced in darkness. Tomato plants, moreover, that had reached the flowering stage, rooted while in darkness when exposed to carbon monoxide but not so well as comparable sets exposed in light. This shows that the presence of carbon monoxide does not prevent the manufacture of food materials, when the plant is in light. They further show that to react to the carbon monoxide young plants must be in a position to manufacture food material. The effects on leaf growth of the 108 species treated are noted. Carbon monoxide was found to cause growth rigor and loss of sensitiveness to external stimuli and is accordingly considered as an anaesthetic.

294. DAY, L. H. 631.535.2

Is the increased rooting of wounded cuttings sometimes due to water absorption ?

Proc. Amer. Soc. Hort. Sci., 1932, 29 : 350-1.

Experiments are briefly outlined in which cuttings of various plants such as California privet, quince, muscat grape, were tested for possible stimulation of root formation by different forms of wounding. Wounding was done by cutting out a slice of bark and wood on one side of the lower 2 inches, by making 4 slits through the bark at the lower end, by scraping away the outer bark from the lower 2 inches and in the case of the grape by ringing 1 inch above the lower end. At the outset wounded cuttings made distinctly more rapid growth, but in quince by June the difference in top and root growth was scarcely visible. Wounded grape cuttings maintained superiority over unwounded until their removal from the soil in June. Further experiments with Bartlett pear cuttings, desiccated till they had lost 20% of their weight, indicated that

desiccated cuttings absorb more water if wounded. Other experiments tested the effect of covering wounds with clay. Tests in September with leafy cuttings wounded variously, both with and without the clay paste, showed that during days of high temperature and low humidity only the cuttings with clay-covered slits did not wilt. Leafless pear cuttings so treated broke into new shoot growth, while treated otherwise they remained dormant.

Growth, Nutrition.

295. ASAMI, Y., AND ITO, H. 634.13-1.542.21 : 581.192

A preliminary report on the effects of summer pinching upon the carbohydrate and nitrogen contents of the Japanese pear shoots. [In English.]

J. Hort. Assoc. Japan, 1933, vol. 4, No. 2, pp. 8, bibl. 3.

The work was done on three 20-year-old trees of *Pyrus serotina* Roxb. var. *Imamuraaki*. In the first year, 1931, pinching, which consisted of removal of 2-3 cm. of soft terminal growth, was carried out when the shoots had nearly finished their most active growth. No difference could be found in the carbohydrate and nitrogen contents of the treated and the untreated shoots. In 1932 pinching was done a month earlier, at a time of rapid growth, and the shoots were analysed. The pinched shoots, especially in their upper portions, were evidently richer in soluble and insoluble nitrogen than the corresponding portions of the check shoots. In opposition to general theory the data show that pinching lowers the carbohydrate/nitrogen ratio. The authors consider that the rather large increase in nitrogen is the most remarkable effect of pinching. This suggests, they say, that when flower bud formation is caused by pinching, the increases in nitrogen should therefore be considered as a cause thereof, if this is interpreted from the carbohydrate/nitrogen ratio standpoint.

296. HALLER, M. H., AND MAGNESS, J. R. 634.11-1.547.4/5 : 581.45

Relation of leaf area and position to quality of fruit and to bud differentiation in apples.

United States Dept. Agr. tech. bull. 338, 1933, pp. 35, bibl. 42.

The investigation was carried out on trees in the variety orchard at Arlington Experiment Farm, Rosslyn, Virginia, beginning when the apples were $\frac{1}{2}$ -1 inch in diameter in May and June. Apples were grown on both ringed and unringed branches with different leaf areas per apple, and with a given leaf area at different distances and different directions from the fruit. On branches with different leaf areas per apple, bud differentiation was determined; growth measurements of fruit were made and chemical compositions determined for all branches. On unringed branches the effect of variation of leaf area on the composition of the fruit and on the size was insignificant. On ringed branches there was an increase in the size of fruit accompanied by an increase in the leaf area, the maximum fruit size being obtained with 30 leaves per apple, increase of leaf beyond this having little effect. Increase in size of fruit, however, was not proportional to the increase of leaf area. The size of the fruit at harvest was correlated with the size of the fruit early in the season. On ringed branches the apples showed an increase in dry weight and in total sugars. Dessert quality associated with a high concentration of total sugars improved with an increase of leaf area, up to 30 leaves being necessary to produce good average quality fruit, while 50-75 leaves produced extra quality in flavour and texture. About 30 leaves were enough to produce good colour; further increase of leaf area did not increase colour but tended to decrease it by shading. Leaves may be a considerable distance from the fruit, thus little reduction in size and composition of the fruit occurred when no leaves were within from $4\frac{1}{2}$ ft. in Grimes Golden up to 10 ft. in Baldwin as compared with apples grown with leaves close to the fruit. On ringed branches left with 1 fruit and 20 leaves the fruit showed no significant difference whether the leaves were above the fruit, below the fruit or on separate branches. Blossom bud formation occurred on ringed branches having a large leaf area per apple but not on branches having a small leaf area. Sufficient blossom buds for a normal crop could be produced by 20-30 leaves

per fruit. Results from the thinning operations seem to indicate that the amount of fruit thinning should be regulated by the number and size of leaves per fruit rather than to a fixed interval between the fruits as usually practised. Fruit thinning was shown to exert a great influence on fruit bud differentiation even as late as June 25th.

297. IMAMURA, Y., AND HURUYA, M. 638.2 : 634.38
Concentration of cell sap in mulberry leaves. [In Japanese. English abstract
 in *Jap. J. Bot.*, 1933, Vol. 6, p. (67).]
Bull. Seric. and Silk Ind., Japan, 1932, 4 : 142-6.

The cell sap concentration of mulberry leaves was studied by a plasmolytic method using NaCl solution of various concentrations. The cell sap concentration in the leaves increased successively in the following order—upper epidermal cells, lower epidermal cells, spongy parenchyma cells, palisade parenchyma cells. In the development of the shoot in the first leaves cell sap concentration is low, rises with successive leaves and then descends. The same gradual rise and decline is found in the individual leaf.

Pollination.

298. BRANSCHIEDT, P. 581.162.3 : 634.1/2
 Weitere Beiträge zur Frage der Fertilitätsverhältnisse bei Kern—u. Steinobstsorten. (**Further contributions to the question of fertility relationships in pome and stone fruit varieties.**)
Gartenbauwissenschaft, 1933, 7 : 546-66, bibl. 26.

The author discusses the different lines of study which have lately been developed from initial investigations on the physiology of pollen germination. His own work has served to confirm previous experience. As regards pome fruits all experimental work points, in his opinion, to the necessity for not planting unmixed stands. Authenticated cases of adequate pollination in pure stands are in all probability due, as in the case of the Napoleon cherry also, to the so-called pure stands not being genetically true, trees which are morphologically alike possessing nevertheless appreciable physiological genetic differences. He notes that among pears Williams and Louise Bonne are found to be intersterile; that Nouveau Poiteau's parthenocarpic tendency is of commercial importance.

He finds that sour cherries are better pollinated by sweet cherries than vice versa, that the tetraploid, Reine Hortense, is poor both as mother and father variety, that his previous observations are confirmed, namely that cherry pollen can be wind-borne as between adjacent trees. Further work also emphasizes the importance of local varieties in pollination and the necessity for pollination tests under different environmental conditions.

299. AFIFY, A. 634.23 : 581.162.3
Pollen tube growth in diploid and polyploid fruits.
J. Pom. Hort. Sci., 1933, 11 : 113-9, bibl. 14.

This study was undertaken with a view to ascertaining the behaviour of incompatibility as expressed by pollen tube growth in some of the diploid and polyploid varieties of cherries, plums and apples. The writer, studying pollen tube growth in the self-sterile cherry variety, Bedford Prolific, was able to demonstrate that this self-sterility was due to the failure of the pollen tubes to travel the whole length of the style and fertilize the ovules. He was able to recognize two kinds of pollen grains, (a) those which failed to germinate and (b) those which penetrated the stylar tissue for a short distance only. The writer attributes the failure of the former class to germinate to generational sterility and of the latter to incompatibility. In the case of a cross between Bigarreau Frogmore as female and Governor Wood as male a third type of pollen grain was recognized in addition to types closely approximating to those enumerated above. These travelled the full length of the style and reached the ovary. Pollen development in the plums was studied, pollen of a seedling between Comte d'Althaus × Jefferson, which fails to set when

crossed with Jefferson but which sets a full crop when the reciprocal cross is made, being applied to flowers of Jefferson. In this cross five classes of pollen could be differentiated, (a) grains which did not germinate owing to generational sterility, (b) those which developed a short pollen tube which ultimately bent upwards and stopped growing, (c) those which grew about a quarter of the length of the style, (d) those which grew to approximately half the length of the style, and (e) those which travelled the full length of the style and effected fertilization. A cross was made between the apple varieties Cox's Orange Pippin as female and Ellison's Orange as male. The former is known to be and the latter is thought to be a diploid variety. Four types of pollen grain were found, (a) those which did not germinate through generational sterility, (b) those which put forward a short tube which bent upwards and stopped growing, (c) those which grew to approximately one-third of the length of the style, and (d) those which penetrated the full length of the style and reached the ovary. In discussing his results the writer points out that in dealing with the diploid cherries the behaviour of incompatibility was fairly simple, no intermediate grades of growth occurred between total inhibition and the normal functioning of the pollen. The observed behaviour of pollen tube growth agreed with expectation on a disomic basis. In the plum and apple varieties the incompatibility behaviour was much more complex with greater variation in pollen tube growth. This was due to the polyploid constitution of these fruits. Thus, the expression of incompatibility was shown to be more complex and variable in polyploids owing to the polymeric condition of the factors which determine incompatibility in polyploids.

H.M.T.

Manuring and Cultural Practice.

300. WALLACE, T., AND PROEBSTING, E. L. 634.1/7-1.83
The potassium status of soils and fruit plants in some cases of potassium deficiency.
J. Pom. Hort. Sci., 1933, **11** : 120-48, bibl. 17.

In a further paper to be published by Proebsting in the next number of the Journal the behaviour of buckwheat and tomatoes as compared with that of apple trees on the same potassium deficient soils, as well as the form of the soil potassium which is apparently utilized by these crops are noted. For the investigations recorded in this first paper 23 centres were selected, 11 of apples, 8 of plums and 4 of bush fruits, including 3 of gooseberries and 1 each of black and red currants. Soil determinations were made on surface soil samples and a few subsoils of water extractable, citric soluble (Dyer's method) and replaceable potassium. The soil was representative of manured, potassium deficient areas, and areas to which heavy dressings of potassic manures and farmyard manures had been given and had effectively corrected the starvation effects. The main point of interest is considered by the authors to lie, as regards the effects of the added manures, in the fact that the values for the different forms of potassium were thereby raised to an appreciable extent in the surface soil and that large percentages of the dressings applied were retained in the surface soils in the base exchange complex.

301. HEIMENDAHL, A. VON. 634.1/2-1.8
 Düngung der Obstbäume mit Hilfe der Motorbaumspritze. (Manuring with the help of a motor sprayer.)
Obst- u. Gemüsebau, 1933, **79** : 22-3.

The possibility of applying fertilizers by means of soil injections in soil deficiency trials has already been considered in America (*Soil Science*, 1931, 31 : 407-9, *H.A.*, 1931, 1 : 4 : 347). In the present article the writer describes the adoption of the system in a commercial orchard for the introduction of Nitrophoska in solution. The outfit used was a 300 litre motor-spray with two nozzles developing a pressure of 20 atmospheres each. The apparatus is fitted with two fertilizer lances. The lower part of the lance is hollow with four holes pierced just above the point, and through these the solution is driven at the pressure desired. The actual lance is 35 cm. (13½ in.) and is fitted with a footplate at the top. It is driven into the earth up to this

plate. Where the tubing enters the lance a valve is fitted, capable of being opened or closed at will. The tube comes in just above the footplate, an extension of the lance being continued upwards to a handle at the top. The price of the lance, handle, etc., is stated to be 20 marks (i.e. 25-30s.) with valve and 13 marks without. The procedure is as follows:—The motor stops between the rows while a man on either side injects fertilizer round the trees for the number of seconds previously determined. The pressure prevents the filling of the holes with earth. The liquid was found on examination not to move upwards but instead to tend to press the soil above it upwards. It was found to penetrate out from the lance to a distance of 40 cm. ($15\frac{3}{4}$ in.) during the actual spraying, while afterwards it obviously reached further. Figures given of actual trials in progress are:—30-year-old standard apple trees—10 holes made within the spread of the branches—10 seconds' injection in each case—5% Nitrophoska so used that each tree received about 1 kg. of fertilizer. In this way 190 trees were treated in $7\frac{1}{2}$ hours including filling the container 11 times. The writer does not suggest that these are correct or desirable amounts, which he considers can be determined only by experiments.

302. LIERKE, E.

634.11-1.8

Apfældüngungsversuche.* (Apple manurial trials.)

Gartenbauwissenschaft, 1933, 7 : 467-88.

This paper gives the results of apple manurial trials at two centres, Ittendorf and Cölsa. In both cases the material consisted of newly planted bush trees on dwarfing stocks, "the Doucin" in particular being mentioned. Soil conditions and climate were markedly different. At Ittendorf the soil was a deep rich loam and the climate warm and moist, while at Cölsa rainfall was low, the position exposed and the soil sandy. Eight varieties were used at Ittendorf and four at Cölsa, Cox's Orange Pippin being included at both centres. The manurial treatments were:—Ittendorf=O : NP : NK : PK : NPK. Cölsa=O : Lime : NP : NK : PK : NPK : NPK + Lime. *Results*.—Ittendorf : While there was considerable varietal variation the author shows, by taking the mean crop of all varieties, that complete manuring was justified economically, the return being 1.6 marks for each mark expended. The manurial effect was shown most markedly by the heaviest cropping variety, the return in this case being 12.6 marks. While the value of the fruit was decreased more by the omission of N than by that of K or P, the highest return for money spent on manuring was obtained by the use of potash, phosphate giving the lowest. Cölsa : The cost of complete manuring was well repaid with every variety. Total profit decreased most when K was omitted, P holding second place and N only third. The importance of manuring apple trees on these sandy soils is stressed and particular emphasis given to the desirable results of using potash. The author also gives a detailed account of soil investigations at Cölsa, samples of soil and subsoil from all plots being examined for lime, potash and phosphoric acid content by Neubauer's seedling germination method. W.A.B.

303. HARLAN, J. D., AND COLLISON, R. C.

634.11-1.84

Experiments with commercial nitrogenous fertilizers on apple orchards.*New York State Agr. Exp. Sta., Geneva, bull.* 623, 1933, pp. 33.

An account is given of a series of fertilizer experiments conducted since 1927. These were carried out on commercial apple orchards, mostly in poor condition, and were designed primarily to test the relative merits of various nitrogenous fertilizers when applied to apple trees for the most part allowed to go down to natural grass and weeds. In addition summer and fall dressings were compared and the relative value of "on" and "off" year applications investigated. In further treatments superphosphate and potash were applied. In the various experiments each treatment was repeated on 6 to 10 trees arranged systematically in the orchard. Although the method is only strictly applicable to chance arrangements in a field experiment, the "analysis of variance" was used in the evaluation of the results, the orchard being divided so that each treatment occurred in a number of irregularly shaped blocks. A description is given of this method of statistical analysis. It is shown that in orchards of low productivity yields were

* Full translation available.

increased by the annual use of nitrogen, when applied early in the spring, and that the more readily available forms of nitrogen were the most satisfactory in this respect. The other comparisons tried yielded no results in these experiments. T.N.H.

304. KIMBALL, D. A. 631.432 : 634.11-1.547
The influence of soil moisture differences on apple fruit colour and condition of the tree.

Scientific Agr., 1933, **13** : 566-75, bibl. 14.

The investigation, started at Guelph, Ontario, in 1930, was carried out on 380 trees forming part of a manurial experiment. The soil was poor, being low in organic matter, nitrogen, phosphorus and potash. The pH was from 6.0-6.5. Very reasonable applications of commercial fertilizers, however, were found to produce good quality and quantity of fruit. The manurial trials consisted of applications of nitrogen, phosphorus and potassium, alone and in combination. It soon became apparent that other factors than the fertilizer treatment were affecting fruit colour. Borings revealed a uniform soil 6 ft. to 7 ft. in depth across the area, below this being clay or clay and sand areas. Roots had penetrated to the depths explored. Moisture differences were established at greater depths, it is stated, than are usually considered in orchard investigations. It appeared that as soon as a clay or clay and sand layer of any size was reached, the percentage moisture increased from a level of 2.5% to 12-20%. The greatest moisture was found in one portion of the area, and it was precisely this area which carried the highest coloured fruit irrespective of the fertilizers used. No connection between fertilizers and fruit colour was established. As regards tree conditions the moisture variation was not shown (on 3-year records) to have had any relation to tree growth or cropping.

305. ALDRICH, W. W., AND FLETCHER, L. A. 634.11-1.542.27-1.547.4/5
Relation of foliage system and fruit thinning to biennial bearing in apples.
Proc. Amer. Soc. Hort. Sci., 1932, **29** : 56-61, bibl. 7.

This is a continuation of studies noted *Ibidem*, 1931, **28** : 599, *H.A.*, 1932, **2** : 2 : 135. Thinning heavily to increase the leaf area per fruit on vigorous trees resulted in increased fruit bud formation when done within 6 weeks of the blossoming but not if done later. With less vigorous trees early thinning had less effect than on the vigorous trees, while later thinning had no apparent effect on fruit bud formation.

306. POPOFF, V. P. 631.432.2
Methods and devices used in the study of the dynamics of soil moisture. [Russian-English summary 5 pages.]

Scientific Research Inst. for Southern Horticulture, bull. **19**, 1933, pp. 158.

The author claims that work in 1928, 1929 and 1930 has shown that correct estimations of soil surface evaporation and water percolation to deep soil layers may be obtained under fallow conditions by the use of his evaporimeters Nos. 5 and 8. These, which merely differ in size, are described. Measuring the water supply in the soil by boring at the outset of the growing period, taking into account by means of the rain gauge the precipitation, and noting evaporation and percolation by the evaporimeter during the growing period make it possible to determine the water balance in the soil and so compute the water supply in the soil at the end of the growing period. The last computation has been found by boring tests to be fairly accurate, the deviation in three years being only ± 4 mm., ± 5 mm., ± 4 mm. respectively. Transpiration of plants under natural growth conditions can also be determined by the use of the evaporimeters, results tallying with those obtained by what the writer calls the "exclusion" method. This consists of periodical determination of soil moisture by the boring method in a plot containing a crop. He finds that transpiration can be determined in plants having only small nutrition areas by the use of evaporimeter No. 8, while the exclusion method must be used when the nutrition areas are comparatively large as in the case of fruit trees. He considers that any additional evidence required on water properties of soil can be got by the use of Popoff's "plane" (volume weight and total soil porosity) and of Briggs and Shantz's plant wilting coefficient method, and, for determining the capillary moisture holding capacity of the soil, by flooding the soil.

307. FLETCHER, L. A. 634.11-1.542.27-1.55

Effect of thinning on size and colour of apples.

Proc. Amer. Soc. Hort. Sci., 1932, 29 : 51-5.

In 1931 distance between fruit and in 1932 leaf area* by spur count was used as a basis for thinning. Previous counts having shown that an average spur supported about 5 leaves, one fruit was left on every tenth spur if 50 leaves per fruit were desired. In 1931, as thinning distance increased, colour development and size of fruit increased both in Jonathans and York Imperials. In 1932 again Jonathan fruit increased in colour development and size following thinning and the table shows that thinning to 50 leaves per apple will result in good sized and well coloured fruit, when moisture supply is not a limiting factor. As regards the York Imperials a spring application of nitrate of soda resulted in decreased colour formation in the unthinned trees and in those thinned to 50 leaves per apple. Fruit thinned to 100 leaves per apple had the same colour development on the nitrated as on the un-nitrated trees. Moreover, size increase of fruit as the result of thinning was more marked on the nitrated than on the un-nitrated trees.

308. AUCHTER, E. C., AND SCHRADER, A. L. 634.11-1.547.4/5-1.55

Possibilities of effecting biennial bearing in York Imperial apples in the Cumberland-Shenandoah valley.

Proc. Amer. Soc. Hort. Sci., 1932, 29 : 62-70, bibl. 7.

This most interesting article details the attempts made to change a biennial into an annual habit. Treatments tried were, (1) special pruning designed to stimulate spur growth and long terminal growth in the hope of obtaining over-vegetative spurs which would not form blossom buds in the off-year ; (2) spring applications of N each year ; (3) spring and autumn applications of N each year. The effects of frost and of no special treatments were also observed during the same years 1924-1932. As regards frost, it was found that when this had the effect of thinning, not all the blossoms throughout the tree, but all the blossoms from some spurs, thus reducing the total crop, conditions resulted favourable for successive blossoming and annual crops. This removal of blossoms results in an increased leaf area per fruit left. The lessening of the total number of fruits to be developed and matured allows some accumulation of carbohydrates in many cases, which apparently results in increased blossom formation on the non-bearing spurs. The effectiveness of this early blossom thinning becomes apparent and indicates that possibly thinning of fruits after setting, especially if it is done heavily enough greatly to increase the leaf area per fruit left, may, as suggested by Aldrich [see No. 305 of this issue.—ED.] become an important means of bringing about annual bearing. Although none of the treatments (1), (2) or (3) succeeded in materially influencing the biennial habit, it is thought that heavy early thinning in conjunction with such practices as will stimulate good growth conditions and healthy foliage may have the desired effect, especially if water can be added to the soil when needed.

309. VERNER, L. 634.11-2.112

The after-effects of drought years.

Pennsylvania State Hort. Assoc. News., 1933, 10 : 14-20.

The study was made in West Virginia apple orchards after a succession of three years in which the rainfall had been below normal. At Martinsburg, where the rainfall in 1930 was 46% below normal, thousands of trees died or were severely injured with a resulting crop loss of 50%. There was a marked variation in the effects in different orchards. The rainfall, low though it was, was not so low as that of other districts where apples are grown very successfully. Although trees habitually used to a large water supply may be unable to maintain their usual vigour when the supply is suddenly diminished, it is considered here that the drought injury was due mainly to other devitalizing conditions, the results of careless cultivation, and that the drought accentuated these conditions to a point when the tree could no longer resist. Trees which had been properly cultivated suffered little from drought.

* See also 296.

The following also is noted :—

LIERKE, E. Düngungsversuche zu Obstbäumen u. Beerensträuchern. (**Manual experiments on fruit trees and bushes.**) [English summary.] *Ernährung der Pflanze*, 1933, 29 : 248-51.

SMALL FRUITS AND VINES.

310. KNIGHT, LUCY D. M. 634.711 : 581.192 : 664.85.711

A contribution to the knowledge of the chemistry of raspberry varieties with special reference to its bearing on canning quality.

Long Ashton Res. Sta. Ann. Rept. for 1932, 1933, pp. 32-46, bibl. 7.

The writer describes the methods adopted in an attempt to correlate chemical properties of fruit with canning excellence as shown in colour, texture, sweetness and acidity, flavour, and clear character of syrup. The fruits examined were from varieties of commercial merit and pedigree stock and were comparable in practically every cultural respect. In the canning trials a sample of each of the varieties was canned at the proper stage of ripeness and the products examined 6 months later. In the chemical investigations the following constituents were estimated at the time of canning :—total nitrogen, titratable acidity, total and reducing sugars, sucrose and soluble pectin. No apparent correlations were found to exist between the canning quality of the fruits and the chemical composition thus determined.

311. TROCHAIN, YVONNE. 634.73

Les Vaccinium comestibles. (The edible varieties of Vaccinium.)

Rev. Bot. Appl., 1933, 13 : 173-89, 268-75 and 319-29, bibl. 54.

This article, the data for which are derived almost entirely from American sources, gives a full descriptive account of the modern methods of growing the varieties of *Vaccinium* at present in cultivation, chiefly the cranberry (*V. macrocarpum* Ait.) and the blueberry (*V. corymbosum* L.). Pests and diseases and their proper treatment are dealt with. There is in conclusion a discussion of about 20 species of edible *Vaccinium* not yet in cultivation drawn from all continents except Australia. The author remarks that, even if a wild variety is itself unfit for cultivation, its presence indicates the probability that the locality would grow a commercial kind with success. One of the principal advantages of *Vaccinium* culture is that it makes use of peat lands hitherto of little value and so, as in America, may bring prosperity to regions where conditions of life are usually hard.

312. DAWE, C. V., AND HORSMAN, H. T. 634.75

An economic inquiry into the production of strawberries.

Bristol Univ. Dept. Agr. and Hort., Economics Branch, bull. 8, 1933, pp. 36, stencilled.

A report of an investigation made into the economic position of the strawberry growing industry in the Bristol Advisory Province. The areas covered were the Cheddar Valley in Somerset (small holdings), an area round Bromham in Wiltshire (small market gardens) and the large fruit and vegetable growing areas in Herefordshire and Worcestershire. The first part of the survey deals in detail with the information obtained from 70 survey schedules received from the Cheddar Valley. The second section deals with cost accounts in Herefordshire, Worcestershire and in the Cheddar Valley. It is shown that in the Cheddar Valley where the average acreage per grower is 1.18 acres, the plots being worked by the family mainly in spare time, the loss per acre is £2 10s. 8d. In the counties where, the acreages being larger, 4.38 acres per grower, the work is done largely by hired labour, there is a profit of £14 18s. 2d. An appreciable amount of this is derived from the sale of runners, a side line which is almost totally neglected in Cheddar. These growers pay more for their plants, straw and manure. The Cheddar district rents are

three times that of the counties, though the district also obtains on the average a higher price per lb. for its fruit. Summing all items the total cost of growing an acre of strawberries in Cheddar is £40 16s. 1d. and in Herefordshire and Worcestershire £32 17s. 5d.

313. SWARBRICK, T., AND THOMPSON, C. R. 634.75 : 581.162.3
Some observations upon the partial self-sterility of the Oberschlesien strawberry and its failure to pollinate Tardive de Leopold.

Long Ashton Res. Sta. Ann. Rept. for 1932, 1933, pp. 24-31.

Large areas have been planted up in recent years with Oberschlesien and Tardive de Leopold by reason of the vigorous growth and resistance to disease and to the strawberry aphid shown by these varieties. It has been found that, when these two varieties are planted together in the absence of other strawberry varieties, complete crop failure of both varieties often occurs. Where only partial failure occurs, it is found that the stocks are not pure but show admixture with Paxtons and Sovereigns. Pollination and pollen germination experiments showed that Royal Sovereign was an excellent pollinator for Oberschlesien and for Tardive de Leopold, that Oberschlesien and Tardive were from an economic standpoint self-sterile and intersterile, that the viability and vigour of Royal Sovereign pollen was excellent, that of Oberschlesien poor, while Tardive de Leopold produced abortive stamens only and no pollen. The recommendation is made that these three varieties make a desirable combination, that the Oberschlesien and Tardive de Leopold beds should not be more than 10 yards wide and should adjoin beds of Royal Sovereign not less than 5 yards wide.

314. HALLER, M. H., AND OTHERS. 634.75 : 581
The interrelation of firmness, dry weight and respiration in strawberries.
Proc. Amer. Soc. Hort. Sci., 1932, 29 : 330-4, bibl. 8.

A study was made of the dry weight, firmness and respiration of different varieties of strawberry grown under similar conditions and picked at the same stage of maturity. A direct correlation was found to exist between the dry weight and the firmness of the different varieties. The dry weight was also found to be directly correlated with the respiratory rate when figured on a fresh weight basis. A direct correlation also existed between firmness and respiratory rate computed on a fresh weight basis. The rate of respiration computed on a dry weight basis is considered a more reliable index of metabolic activity. On this basis there was no apparent relation between respiratory rate and firmness or between respiratory rate and dry weight. There was no apparent relation between firmness and the respiratory ratio, i.e. cc. CO₂ : cc. O₂, of the different varieties. [Authors' summary.]

315. SCHILLETER, J. C. 634.75-1.547.4/5
Time of bud differentiation in the Dunlap strawberry.
Proc. Amer. Soc. Hort. Sci., 1932, 29 : 325-9, bibl. 5.

Observations were made on bud differentiation and the weather immediately preceding it. In 1924 low temperature and lack of moisture preceded it ; in 1925 lack of moisture, in 1927 lack of moisture, in 1928 low temperature. These data agree with those of other investigators and the author concludes that the external factors of low temperature or lack of moisture taken separately or in combination are accompanied by a decrease in vegetative growth and are associated with the time of fruit bud formation.

316. DARROW, G. M., AND WALDO, G. F. 634.75-1.8-2.4
Effect of fertilizer on plant growth, yield and decay of strawberries in North Carolina.
Proc. Amer. Soc. Hort. Sci., 1932, 29 : 318-24.

The Missionary variety was used in 1928 and 1929 and the Blakemore in 1930 and 1931. Fertilizers were applied at different dates as follows :—September 28th, 1927 and March 1st, 1928 ; January 26th, 1929 ; February 6th, 1930 ; and September, 1930 and January, 1931. The applications for the 1929 crop were based on an 1,800 lb. application of 6P₂O₅-3NH₃-5K₂O fertilizer

and in 1930 and 1931 on a 1,500 lb. application of a 8-4-6 fertilizer. The 1928 test included 20 different treatments of 1/20th acre each. The 1929 test was on triplicated plots .013 acres in size. The 1930 and 1931 plots were in triplicate and 1/100th acre. From this somewhat patchwork scheme average figures of three years show the following results. Potash treated plots yielded an average of 29% better than no fertilizer plots, superphosphate treated plots 42%, but K + P plots only 39%. Organic N plots showed an increase of 75%, inorganic N of 56%, but inorganic + organic 132%. N + K plots showed 71% increase, N + P 65%, N + K + P 63%, N plots 109%. Plots untreated or with only K + P produced berries late in maturing. Inorganic N led to rather rank growth which encouraged fungal infection. The nitrogen supplied by tankage and cottonseed meal was found superior.

The authors consider that, since the amount of decay in the fields was correlated with extent of leaf growth and nitrogenous fertilizers increase this, a balance should be reached between the use of nitrogen to increase yields and the extent of leaf growth that will not unduly increase decay.

317. TAYLOR, R. W. 634.75-1.84

Influence of nitrogenous fertilizers applied at different dates on the numbers of flower clusters, flowers and fruits of the strawberry.

Proc. Amer. Soc. Hort. Sci., 1932, 29 : 313-17, bibl. 4.

The experiments recorded here were made in Alabama in the fall and winter of 1931-2, which was a particularly mild one. From them and from previous experiments the author deduces that nitrogenous fertilizers should be applied to strawberries in the fall and again about three months prior to first harvest to ensure production of a large number of flower clusters necessary for full cropping. A later application may also be advisable to ensure berries of a large average size.

318. BAUR, E. 634.8-1.523

Der heutige Stand der Rebenzüchtung in Deutschland. (The present position of vine breeding in Germany.)

Züchter, 1933, 5 : 73-7.

The author first deals with the errors into which grape vine breeders are apt to fall. He then shows how uneconomical it is to use very expensive vineyard land for the selection work and how necessary it is that plants should be tried out under, if anything, harder environmental conditions than they are likely to encounter in the vine districts. Finally he gives an idea of the plan which governs work at Müncheberg and is as follows :—

Every year 5-10 million seedlings are sown in the special glasshouses and are there tested for *Peronospora* resistance. Those standing this test are placed in observation quarters at Müncheberg where they serve as selection material for the breeding of rootstocks and direct producers. This selection goes on simultaneously with three distinct aims :—(1) for the "Ideal" vine, i.e. one with good varietal characteristics (as a wine or table grape) combined with resistance both to mildew and phylloxera. The goal of such a scheme lies far ahead and hence breeding is also being carried on with two more modest aims ; (2) for vines which are resistant to mildew and phylloxera and under German climatic conditions will function better as rootstocks than those now used ; (3) for vines which are resistant to mildew and otherwise possess the qualities of a high-class vine. The writer considers that aims (2) and (3) are fairly easy of attainment which should be reached in a few years. Naturally all resistance noted at Müncheberg needs to be tested in the growing districts before it can be considered definite.

319. ROUSSOPOULOS, M. N. 634.873.4

Sur les pépins du raisin de Corinthe. (Seeds in currants (*Vitis corinthiaca*).)

Rev. Bot. Appl., 1933, 13 : 402-9.

A comparative morphological and chemical examination is made of the seeds, both fertile and infertile, produced by *Vitis corinthiaca*, the dried currant of commerce. The currant is usually seedless, or the seeds if present are in an extremely rudimentary state. (The Greek Government

forbids the sale of samples containing more than a very low percentage of seeds.) Occasionally instead of the usual 2% of grapes containing seeds, a much larger percentage contain seeds, these being mainly infertile. This is ascribed by the author to optimum climatic conditions combined with heavy manuring. Examples from experimental plots are given to show that in the bumper year of 1930 the plots receiving complete chemical fertilizer produced 35% of grapes which contained seeds, those receiving stable manure somewhat less (figures not quoted), while the unmanured controls produced 11.53%. In normal years none of these plots produce more than 1.4% of such grapes.

320. DE CASTELLA, F.

634.8-1.542

Pruning the vine. Avoid serious wounds.

J. Agr. Dept. Victoria (Australia), 1933, 31 : 271-6.

In pruning the vine it is recommended that, when large branches have to be removed, they should not be cut off flush but at a certain distance from the base. In a year or two when the stub has quite died, but not before, it can be removed. The reason for this divergence in the case of the vine from the pruning practice in use with other hard wooded subjects is to be found in the fact that the vine, owing to its soft and spongy wood, is only able to form new tissues so sparingly that the cut is never entirely covered and in the case of large sections scarcely at all. Further, from every cut a wedge of dead wood will extend into the stem or crown of the tree and a repetition of important cuts "results in the presence of so much dead wood as to leave but little living tissue in the much mutilated crown", and growth and fruit production are seriously impeded. If stubbed rather than cut close, much of the die-back will be in the stub and will in due course be removed with it.

321. LAGATU, H., AND MAUME, L.

634.8-1.8 : 581.192

Composition comparée, chez la vigne, de feuilles homologues prises respectivement sur des souches fructifères et sur des souches privées de leurs grappes. (**Comparative composition of homologous leaves taken from fruit bearing vines and from vines from which the fruit has been removed.**)

C. R. Acad. Agric., 1933, 196 : 1168.

The trial was made on different vines, one lot of which were deprived of their fruit clusters, the other allowed to fruit. Treatment and soil were similar. It was found that the total content of $N + K_2O + P_2O_5$ in percentage of dry matter is at every stage less in the leaves of the bearing branch than in homologous leaves of the non-bearing branches. Actually, the leaves of the bearing branch are poorer in lime, nitrogen and potassium, but richer in phosphoric acid. Potash deficiency is, however, apparent and it is not certain that the respective potash contents would be relatively the same, were the potash content of the soil and leaves up to normal.

322. LAGATU, H., AND MAUME, L.

634.8-1.8 : 581.192

Composition comparée de la matière sèche de feuilles homologues des rameaux fructifères et des rameaux naturellement stériles d'une vigne. (**Comparative composition of the dry matter of homologous leaves from fruitful and from naturally sterile branches of a vine.**)

C. R. Acad. Agric., 1933, 196 : 1445.

Samples were taken from an Aramon vine grafted on Rupestris at different stages of growth of the two first basal leaves. As regards N and P_2O_5 results were found to be much the same as those obtained with leaves taken from branches bearing fruit and from branches artificially deprived of their clusters on different vines. In spite of statistical fluctuation it is possible to state that the dry matter of leaves taken from fruit bearing branches is poorer in N and richer in P_2O_5 than that of homologous leaves taken at the same time from naturally sterile branches of the same vine. The potash content is not given, as the abnormally low potash content of the leaves due to potash deficiency in the soil gave rise to considerable and contradictory statistical variations in the relative potash contents of the leaves from the two sources.

323. LAGATU, H., AND OTHERS. 634.8-1.84 : 581.192
Etudes des variations de la teneur en azote des points très localisés du feuillage de la vigne. (**Variations in nitrogen content at particular points in the foliage of the vine.**)
C. R. Acad. Agric., 1932, 194 : 679.

Samples were taken at different dates with a punching machine from the edges of leaves situated at different distances from the base of a branch and the nitrogen was determined. It was found that N content diminished with age, for instance N content was lower for every leaf whatever its situation on July 17th than on May 15th. Again every leaf appearing on a particular branch later than another contained at the same time more nitrogen than the earlier leaf. Further experiments were made to determine the effect of nutrients on N content, the pieces of leaf tested being from identical positions on vines untreated, treated with 500 g. K_2O as KCl , 500 g. P_2O_5 as supers, 500 g. N as sulphate of ammonia. The table given shows :—(1) that the evolution in N content of two basal leaves, coming respectively from 2 vines definitely similar in appearance and treatment, is identical—a fact which justifies judging from sample ; (2) that strong phosphatic manuring prevents the leaf absorbing much N at first ; strong potassic manuring does not check N absorption ; strong phosphatic manuring results in a definite increased N content in the leaf.

324. LAGATU, H., AND MAUME, L. 634.8-1.83
*Application du diagnostic foliaire : il suggère, contrôle et limite le redressement alimentaire d'une vigne mal nourrie. (**Leaf diagnosis as a means of determining the exact manurial treatment necessary to restore a starved vine.**)
C. R. Acad. Agric., 1932, 194 : 812.

Investigations by the authors since 1923 on Aramon grafted on Rupestris have shown that a vine's nutrient conditions can be tested by determining the amount of potash in the leaf immediately at the base of the fruit clusters. The potash should be at least as great as that of the P_2O_5 or N in order to ensure the best return which the particular vine can give. In 1929 to 1931 on a soil very deficient in potash, where leaf scorch was found and the analysed leaves showed potash deficiency, the effect was tried of adding varying amounts of potash. It was found that three annual applications of 600 kg. per hectare (534 lbs. per acre) KCl were necessary to replace soil deficiency and supply the needs of the plants as well. Leaf diagnosis alone entirely substantiated during that time (1) the imminent collapse of the vine owing to K starvation, (2) the gradual rehabilitation due to added potash, and (3) the final complete restoration to health in 1931 in the one plot which received the full amount, i.e. 600 kgs. in each of the three years.

PLANT PROTECTION OF DECIDUOUS FRUITS.

325. SLATE, G. L., AND RANKIN, W. H. 634.711-2.8
Raspberry growing in New York State : cultural practises and disease control.
New York State Agr. Exp. Sta., Geneva, bull. 625, 1933, pp. 62.

More than half this bulletin is devoted to disease problems, and the major portion of this to mosaic and other diseases probably of a virus nature.

326. BRADFORD, F. C., AND FOLEY, L. L. 634.11-1.541.11/12
Infectious variegation of the apple.
J. Agr. Research, 1933, 46, 901-8, bibl. 13.

An account is given of grafting experiments whereby the variegation which is possibly endemic, though not always apparent in Steele apple, was transferred to the foliage allowed to be produced for purposes of investigation by the stock. Steele is usually worked on an intermediate stock

* See also *H.A.*, 1933, 3 : 1 : 57.

which in turn is set on a seedling rootstock. In these experiments a number of different intermediaries were used. With the exception of Tolman Sweet (9%) and Northern Spy (0%) the remaining intermediate stock varieties showed infection in from 50-100% of their number. Of the seedling rootstocks, of those worked direct with Steele 45% became infected, and where there was an intermediary from 13-46%. Variegated scions set in mature trees produced variegation which spread throughout the tree even to the tips of ungrafted limbs. Buds taken from a Steele showing no variegation produced it in seedling rootstocks. Seedling stocks showed higher proportions of pronounced manifestations than did the scions worked on them. There is at present no opinion offered as to the effect of the disease on the health of the tree. It is observed that the apple is a particularly suitable subject for the investigation of infectious variegation owing to the large number of clonal varieties available whose habits of life and responses to environment are well defined and understood.

327. SCHILBERSZKY, K. 632.3 : 634.22
 Ueber die Ursachen der Apoplexie bei den Steinobstbäumen. (On the causes
 of "apoplexy" in stone fruits.)
Angewandte Botanik, 1932, 14 : 536-51, bibl. 17, and 1933, 15 : 105-22, bibl. 31.

The author's work and observations lead him to the following conclusions:—"From the above discussion it may be concluded that gummosis and apoplexy [or 'die-back' ED.] arising therefrom do not correspond with any particular type of disease. Apoplexy is a result of gummosis and gummosis alone is a physiological reaction, which may arise as the result of very different ecological factors or conditions of parasitism, in so far as these are capable of inducing changes important to the condition of the cell. Unfavourable conditions are shown to exist in stone fruits when the tracheae become filled with gum and are thus prevented from conveying the nutrients in solution any further, which results in the death of the part of the tree involved. Death comes about, therefore, as the result of gum formation due to a complex of causes arising from meteorological and ecological circumstances. Climate is of the greatest importance in preparing the way. An inherent capacity for gum formation can only be expected in certain representatives of the natural plant orders under certain conditions which predispose to enzyme production and in the presence of closely related chemical decomposition phenomena. In this respect the *Amygdalaceae* exhibit a definite tendency to gum formation, in which a specific susceptibility founded on the activity of the protoplasm may be recognized." [The author notes in a postscript Rives's work on apoplexy in the apricot, which was published too late for comment in the text. Rives suggests a bacterial agent as the cause of apoplexy (*C. R. Acad. Agr. France*, 1929, p. 77, and *Progrès Agricole* . . . année 48, volume 95, p. 89). For further evidence of the incidence of bacterial disease in its relation to "die-back" the reader is referred also to the following articles by Wormald:—Bacterial diseases of stone-fruit trees in Britain. I. Preliminary note on bacteriosis in plum and cherry trees. *East Malling Res. Sta. Ann. Rept. for 1926 and 1927*, II. *Supplement*, 1928, pp. 121-7; III. The symptoms of bacterial canker in plum trees. *J. Pom. Hort. Sci.*, 1931, 9 : 239-55; IV. The organism causing bacterial canker of plum trees. *Trans. Brit. Myc. Soc.*, 1932, 17 : 3 : 157-69; and, On the cause of die-back in plum trees. *Gard. Chron.*, 1928, 84 : 372-3.—ED.]

328. SYLWESTER, E. P., AND COUNTRYMAN, MARY C. 634.11-2.314 : 581.143.3
 A comparative histological study of crown gall and wound callus on apple.
Amer. J. Bot., 1933, 20 : 328-40, bibl. 14.

The work included anatomical and microchemical studies and a re-examination of the question of the distribution of bacteria in the tissues of pathogenic and non-pathogenic overgrowths on apple grafts. While having many features in common from a histological standpoint and showing the same microchemical reactions for cellulose, pectin, lignin and gums, callus and crown gall tissue are found to differ in the following respects. Crown gall has near the surface a zone of dark, polygonal close-fitting cells, easily distinguished from the surrounding parenchyma. Graft callus usually has a periderm similar to that of the normal stem. The test for tannin was

positive in crown gall tissue and negative in callus tissue. Sclerenchyma cells seem to occur only in crown gall, but the presence of small masses of xylem with much reduced pitting makes this diagnosis uncertain. *Pseudomonas tumefaciens* was found abundantly and close to the surface of crown gall tissue.

329. GOODWIN, W., AND OTHERS. 634.11-2.42
The control of apple scab. Allington Pippin and Newton Wonder. 1932.
J. South-Eastern Agr. Coll., Wye, 1933, 32 : 95-107.

The object of this trial was to test out the comparative efficacy of bordeaux mixture, which has to be applied in a fine misty spray, and mustard oil-bordeaux emulsion, which can safely be applied more quickly in a heavy wash to apple foliage. In discussing their results the authors state:—"It would appear that, whereas the oil-bordeaux emulsion was as efficient as or only slightly less efficient . . . in controlling scab in Allington Pippins, the control of scab obtained in the plot of Newton Wonder apples washed with oil-bordeaux was inferior to that obtained in the plot sprayed with bordeaux mixture. It is possible that this . . . is due to biological factors such as differences in the vegetative growth on the previous scab history of the trees in the two plots, but it is more probable that it is due to the inferior fungicidal efficiency of the oil-bordeaux emulsion."

330. MARSH, R. W. 632.42 : 634.13
Observations on pear scab.
J. Pom. Hort. Sci., 1933, 11 : 101-12, bibl. 6.

An account is given of the successive stages of development of *Venturia pirina* in pear shoots. Dissemination of spores from scabbed pear shoots determined by spore trapping in a badly infected plantation was found to be specially heavy in March and April. Under conditions favourable to the disease it was found by trials in 1931 and 1932 that two sprayings were useless, while six sprayings increased the proportion of clean fruit from 2% to 60%. Notes on spray damage are given, particular susceptibility to sulphur damage being recorded in the case of Doyenné du Comice. [From author's summary.]

331. MARSH, R. W. 632.952.2
Trials with a "colloidal" copper spray fluid.
Long Ashton Res. Sta. Ann. Rept. for 1932, 1933, pp. 86-9.

Stirling Castle apple trees, 14 years planted, were sprayed once pre-blossom (3 pints to 100 gallons) and once post-blossom (1½ pints to 100 gallons) with Bouisol (copper content 12.5%). The absence of scab on the controls did not allow its efficacy as a fungicide to be tested, but the additional russetting on the sprayed crop was enough to lower the value of the fruit. With Lane's Prince Albert indications were given by comparison of 6 treated trees against 3 controls that Bouisol is adequate for post-blossom but inadequate for pre-blossom spraying. Tests made on French and Baldwin black currants against leaf spot showed that Bouisol applied after cropping is about as effective as bordeaux applied at that time. A pre-cropping Bouisol treatment had little effect by the end of September and further work is needed to determine whether it may be of value as an adjunct to the standard post-cropping application.

332. GLOYER, W. O. 632.42 : 634.11
Evaluation of applications of lime-sulphur for the control of apple scab.
New York Agr. Exp. Sta., Geneva, bull. 624, 1933, pp. 39, bibl. 22.

An increasing and decreasing series of applications were planned and carried out at Geneva and as a result it was possible to compare the results of single, deferred and various sequences of sprays throughout the season and to evaluate them. The trees were Ben Davis. The writers conclude that the first application should be made at the vulnerable stages of the fungus of the

primary infection. The first application made prior to the first rain period at the unfolding of the buds has been found the most efficient. This permits the greatest margin of safety with the least possibility of serious later infection.

333. McLARTY, H. R.

632.48 : 634.11

Perennial canker of apple trees.

Canadian J. Research, 1933, 8 : 492-507, bibl. 28.

A study of the new disease of apple trees named Perennial Canker (*Gloeosporium perennans*) described in 1925 by Zeller and Childs (*Phytopathology*, 1925, 15 : 728, and *Oregon Agr. Coll. Expt. Sta. bull.*, 217, 1925). The disease is prevalent in Oregon, Washington and British Columbia. Workers have not been able entirely to agree as to the various factors responsible for the spread of the disease. In this paper it is shown that the causal organism of the disease enters the tree through inoculation in late summer and autumn by the woolly aphid and that other factors such as winter injury, time of pruning and precipitation are contributory but not necessary factors for its distribution.

334. KOCH, L. W.

632.42 : 634.22/23

Investigations on black knot of plums and cherries. I. Development and discharge of spores and experiments in control.

Scientific Agr., 1933, 13 : 576-90, bibl. 11.

Black knot is a serious disease of plums and cherries in Canada. The production and dissemination of ascospores and conidia of the causal fungus, *Dibotryon morbosum* (Schw.) T & S, is discussed and orchard and laboratory investigations are described. A control of 95% was obtained by a combined programme of pruning and spraying dormant trees with 3% oil emulsion bordeaux or 1 : 8 lime-sulphur and two later sprays of 1 : 40 lime-sulphur applied at the time the buds were breaking and again at calyx fall.

335. JANCKE, O.

634.11-1.83-2.4/7

Ueber den Einfluss der Kalidüngung auf die Anfälligkeit der Apfelbäume gegen Blutlaus, Blattlaus und Mehltau. Zugleich II. Mitteilung zur innertherapeutischen Schädlingsbekämpfung. (The influence of K manuring on the susceptibility of the apple to aphid, woolly aphid and mildew. Being a second note on pest control by internal therapy.)

Arbeiten aus der Biologischen Reichsanstalt für Land-u. Forstwirtschaft, 1933, 20 : 291-302, bibl. 15.

1. Experiments with increasing doses of K in amounts representing deficiency, normal, and excessive K conditions on Doucin clones of varying susceptibility to woolly aphid and on Northern Spy grafted on crab stock indicated that susceptibility was not in any way affected by these conditions. The test trees were grown in sterile sand, then in nutrient solution and finally in the field. 2. Northern Spy generally showed itself slightly susceptible to woolly aphid, though some of it was highly susceptible. 3. Attacks of the aphid, *Doralis pomi*, were quite unrelated to K manuring. 4. Mildew susceptibility was not diminished at all by K. 5. Applications of K did on the whole lead to increased growth, which in general corresponded with the amounts of K applied. [Author's summary.]

336. KEARNS, H. G. H., AND OTHERS.

632.951/2

Experiments with combined insecticide-fungicide sprays for apples. Progress report.

Long Ashton Res. Sta. Ann. Rept. for 1932, 1933, pp. 66-85, bibl. 7.

1. A review of the present spraying programme on apples suggests the need for a combined wash incorporating a fungicide, an oil emulsion, a contact insecticide and a stomach poison. 2. The preparation of a practicable spray fluid combining lime-sulphur, oil emulsion and nicotine is described. 3. Field trials with an oil-lime-sulphur mixture applied up to the petal fall

stage on Worcester Pearmain apples showed no serious foliage damage. A small trial of lime-sulphur + nicotine and a wetting agent, applied on Worcester at the petal fall stage for the simultaneous control of scab and sawfly, gave promising results. [Authors' summary.]

337. DAWSEY, L. H., AND HAAS, A. J. 632.951.8

A method for determining the quantity of mineral oil retained by leaf surfaces after spraying.

J. Agr. Res., 1933, 46 : 41-9, bibl. 5.

The authors would appear to have improved on English's method for Satsuma orange leaves (*Ibidem*, 1930, 41 : 131-3). They explain their technique in detail and with an illustration of the method used for cold filtration. They summarize as follows :—The quantity of naturally occurring waxes extracted from camphor leaves by ether and by chloroform has been shown to vary in different samples with equal areas of leaf surface. A method is given for the determination of the quantity of paraffin mineral oil retained by camphor leaves after spraying. The oil is recovered from the leaves in its original form, and the amount is measured volumetrically in calibrated Babcock skim-milk bottles. By introducing certain variations the method is applicable to pecan leaves and Satsuma orange leaves. The maximum error in determining oil on pecan leaves was less than 1% ; on camphor leaves and Satsuma orange leaves it was less than 2.5%. An example is given illustrating the use of the method in estimating oil retained by camphor-tree foliage that had been sprayed with emulsions.

338. LINDBLOM, A. 632.951.1

Pyretrum produkterna i insektbekämpningens tjänst. (Pyrethrum products and plant protection.) [Swedish-German summary, 2 pp.]

Statens Växtskyddsanstalt medd., 2, 1933, pp. 24, bibl. 31.

The author reports briefly on the different kinds of pyrethrum which are known to have insecticidal properties. These include *P. roseum*, *P. cinerariaefolium*, *P. carneum*, *P. macrophyllum*. Trials with *P. cinerariaefolium* and *P. roseum hybridum* in Sweden have shown the latter to be much more hardy and suggest a possible future for the production of this plant on a large scale in Sweden.

339. LINDBLOM, A. 632.951.4 : 634.1/2

Jämförande försök med insektdödande vinterbesprutningsvätskor för frukt-trädgården. (Comparative trials of insecticidal winter sprays in the orchard.)

[Swedish-German summary, 4 pp.]

Centralanstalten för försöksväsendet på jordbruksområdet medd., 422, 1932, pp. 24.

An account is given of Swedish trials with a large number of named winter wash preparations against the eggs of *Psylla mali* and *Paratetranychus pilosus*. The washes included tar oils, mineral oils and combinations of the two and included samples from Australia, U.S.A., England and other parts of Europe. Results of treatment on eggs and on the growth of the tree are reported.

340. LANGER, W. 632.951.4

Die Grenzen der physiologischen Wirksamkeit von Obstbaumkarbolineum, insbesondere in der Pflaumenkultur. (The limits of physiological efficacy of winter washes for fruit, especially in connection with plums.)

Gartenbauwissenschaft, 1933, 7 : 590-618, bibl. 14.

This is an account of tests made both in the field on trees, and in the laboratory to determine the exact chemical effects of the different preparations. Among eight proprietary sorts, all of which achieved a fair measure of success in the field, "Neodendrin" was especially noticeable for producing similar effects as the others at very much lower concentrations. It is a tar oil product.

341. AUSTIN, M. D., AND OTHERS. 632.951.4

Studies on the ovicidal action of winter washes, 1932 trials.

J. South-Eastern Agr. Coll., Wye, 1933, 32 : 63-83, bibl. 5.

Laboratory trials were as before (*Ibidem*, 1932, 30 : 183, and *H.A.*, 1932, 2 : 3 : 242) carried out on eggs of *Lygus pabulinus*, washes being prepared by the two-solution oleic acid method of emulsification except in one case where bordeaux mixture was used as the emulsifier, the oleic acid method not being suitable for abnormally hard water. No difference was found in the ovicidal efficiency of solutions prepared thus differently. *Lygus pabulinus* was also the main object of control in the field tests, though at one centre observations were concentrated on control of *Plesiocoris rugicollis* and the control was noted in certain cases on the eggs of aphides and red spider. The action of winter washes prepared from various tar and petroleum oils was on the whole successful, whether these were prepared by the oleic acid method or with bordeaux mixture. The substitution of strained anthracene oil or dinitro-o-cresol for the high-boiling neutral tar oil used in the 1931 trials gave an inferior control of *L. pabulinus*.

342. ROARK, R. C. 632.951.1
A digest of the literature of derris (*Deguelia*) species used as insecticides, 1747-1931.

U.S. Dept. Agr. misc. publ., 120, 1932, pp. 86.

The digest is in the form of a bibliography alphabetically arranged according to authors' names. Accompanying each title is a short abstract. Should the article have also been abstracted elsewhere, a reference is given to the abstracting journal. [We have been informed by the Superintendent of Documents, Washington, that this digest is now exhausted from stock.—ED.]

343. AUSTIN, M. D. 632.754
A note on *Lygus pabulinus* L.
J. South-Eastern Agr. Coll., Wye, 1933, 32 : 168-70, bibl. 6.

Recent observations on this pest show that it does not confine itself for oviposition of its overwintering eggs to the apple, currant and gooseberry, but now also includes the cultivated blackberry much more commonly than was apparently the case in the past. The importance of this to control schemes is noted.

344. SPEYER, W. 632.78
 Kann sich die Obstmade (*Cydia pomonella* L.) ausschliesslich von Blättern ernähren ? (**Can the codlin moth exist on leaves alone ?**)
Arbeiten aus der Biologischen Reichsanstalt für Land- und Forstwirtschaft, 1933, 20 : 183-91, bibl. 11.

Under laboratory conditions codlin moth caterpillars went through their entire life history, pupated and emerged as moths fed on apple leaves only. The pupae and moths were smaller than normal.

345. HARMAN, S. W. 632.782 : 634.11
Codling moth control.
New York State Agr. Exp. Sta., Geneva, bull. 627, 1933, pp. 31.

The difficulty lies in avoiding spray residue in excess of amounts tolerated by law and at the same time controlling the pest. Under New York conditions adequate protection seems to demand lead arsenate sprays in July and sometimes a third application in August, which in all probability necessitates fruit cleaning to get rid of spray residue. The only other spray with comparable effect is calcium arsenate, the use of which would eliminate the lead residue problem but not other residue problems.

346. KEARNS, H. G. H., AND SWARBRICK, T. 632.793 : 634.11
Further observations on the control of the apple sawfly (*Hoplocampa testudinea* Klug.).

Long Ashton Res. Sta. Ann. Rept. for 1932, 1933, pp. 90-94.

Spraying Worcester Pearmain fruitlets with a nicotine wash (8 ozs. to 100 gals. water and spreader) between the 6th and 8th days after petal fall was just as efficacious as in the previous year (*Ibidem* for 1931, pp. 112-7, *H.A.*, 1932, 2 : 3 : 258). A derris rape oil emulsion was equally successful. A derris soap wash (representing a rotenone concentration of 0.004%) was only fairly satisfactory. A colloidal lead arsenate wash and a pyrethrum emulsion (representing a concentration of 0.5% of the flowers) each reduced the infestation by 50%.

347. LINDBLOM, A. 632.796
Bekämpningsförsök mot myror. (Control measures against ants.)* [Swedish-German summary.]

Statens Växtskyddsanstalt medd., 1, 1933, pp. 16.

The repeated use of derris powder at intervals of two or three days in dry weather was entirely successful. Pyrethrum powder, not only that derived only from the flower, but also that derived from the whole plant, roots excepted, of *P. cinerariaefolium*, as well as powder extracted from the entire plant of *P. roseum*, raised at the Research Station, was quite successful.

348. DODD, A. P. 632.51 : 632.96
The present position and future prospects in relation to the biological control of prickly pear.

J. Council Sci. Ind. Res. (Australia), 1933, 6 : 8-13.

An account is given of the methods of biological control whereby an infestation of prickly pear (*Opuntia inermis* and *O. stricta*) covering an area of 60 million acres, or very little less than the total area of Great Britain and Northern Ireland, is in a fair way to being entirely cleared up at infinitesimal cost. This has been achieved mainly through the agency of the cochineal insect, *Cactoblastis cactorum*.

The following also are noted :—

NAPPER, MAUDE E. **Observations on spore germination and specialization of parasitism in *Cystopus candidus*.** *J. Pom. Hort. Sci.*, 1933, 11 : 81-100, bibl. 10.

SWARBRICK, T. **The spraying of farm orchards as a means of increasing the cider fruit crop.** *Long Ashton Res. Sta. Ann. Rept. for 1932, 1933, pp. 47-65.*

ROSEN, H. R., AND BLEECKER, W. L. **Comparative serological and pathological investigations of the fireblight organism and a pathogenic, fluorescent group of bacteria.** *J. Agr. Res.*, 1933, 46 : 95-119, bibl. 47.

Ogilvie, L. **The control of hard rot of strawberry fruits.** *Long Ashton Res. Sta. Ann. Rept. for 1932, 1933, p. 102.*

BÖRNER, C., AND SCHILDER, F. A. **Ueber das bisherige Auftreten der Blattgallenreblaus in Deutschland. (The appearance in Germany to date of the form of *Phylloxera vastatrix* which causes leaf galls.)** *Arbeiten aus der Biol. Reichsanst. Land-u. Forstwirtschaft*, 1933, 20 : 325-46.

JANCKE, O. **Gibt es eine Überwinterungsform der Blutlaus? (Is there an overwintering form of the woolly aphis?)** *Arbeiten aus der Biol. Reichsanst. Land-u. Forstwirtschaft*, 1933, 20 : 303-8, bibl. 5.

GINSBURG, J. M. **The effect of different soaps on lead arsenate in spray mixtures.** *J. Agr. Res.*, 1933, 46 : 179-82, bibl. 6.

CHAPMAN, P. J. **Viability of eggs and larvae of the apple maggot (*Rhagoletis pomonella* Walsh) at 32° F.** *New York State Agr. Exp. Sta., Geneva, tech. bull.* 206, 1933, pp. 19, bibl. 26.

* See also 383.

VEGETABLE GROWING.

349. BROWN, C. A. C. 631.544 : 631.588.1
The use of electric heating cables for hot beds.
Inst. for Research Agr. Engineering, Univ. Oxford, publ., 1933, pp. 48, bibl. 19,
price 1s.

This bulletin reports the conclusions drawn from a study of the electric heating of hot beds both on commercial installations and at the Institute. It is accepted that electrically produced bottom heat will grow plants quite as well as manure hot beds. This study, therefore, is made from an economic standpoint in which the cost of installation and the best methods of combining economic running and efficiency have been investigated. The cost of electrical equipment for a four light frame (lights 6 ft. \times 4 ft.) with the simplest control works out at 17s. per light, with thermostat control the cost would be 30s. per light. An adequate temperature can be maintained with a consumption of 15 kWh. per light per week. Top covering at night and heat insulation reduce running costs considerably. In nurseries the exigencies of other work make thermostat control almost essential. For nursery hot beds a loading of 7.5 watts per sq. ft. is suggested. Costs are very fully gone into and the proposition as regards salad and nursery beds may be considered commercially sound where electricity costs not more than one penny per kWh.

350. MOEN, O. 635.1/7-1.4
 Orienterende prøver med dyrkning av endel gronnsaker på ulike jordarter.
(Vegetable trials in different types of soil.) [English summary.]
Reprint from Meldinger fra Norges Landbrukshøiskole, 1932, pp. 25.

In summarizing 7 years' tests the author brings out the following points. Sand is chiefly noticeable as inducing early ripening. It is very well suited to parsnip and parsley. Gravel (as a medium) has much the same effect as sand. Loam is best of all for general vegetable growing. Clay was found most unsuitable for a large number of vegetables, though rutabaga, beet and tomatoes grew as well there as elsewhere, while scorzonera, peas and beans reached their full development in clay. Silty soil was found particularly good for cabbages. It is very cold and moisture retentive. Large onions grew better in it than in sand. A soil in which clay was mixed gave medium results. The temperatures measured at 15-20 cm. deep varied in the different soils from 15.1° C. (59.18° F.) in sand and gravel to 12.0° C. (53.6° F.) in silt, but were not apparently so important as other factors. Sowing in autumn can only be recommended in light soils. The tests are continuing.

351. KRENGEL, W. 635.1/8-1.87
 Ist die Ioddüngung im Gemüsebau zweckmässig und wirtschaftlich? **(The value of iodine as fertilizer in vegetable growing.)**
Obst- u. Gemüsebau, 1933, 79 : 87-8, bibl. 5.

This is a discussion of experiments on the iodine content of plants, on their method of storing iodine and on the feasibility of increasing the iodine content by using fertilizers known to contain iodine such as Chile nitrate. The conclusion is drawn that the use of such fertilizers for that particular purpose is of doubtful nutritional value to man and is certainly uneconomical.

352. WILSON, H. L. 635.25-1.415
Relation of hydrogen-ion concentration to the growth of onions.
Cornell Univ. Agr. Exp. Sta. memoir 145, 1932, pp. 59, bibl. 28.

Work by Hartwell and Damon in 1914 showed that onions made a marked response to liming on an acid soil. In the author's experiments conducted with water cultures no optimum values for maximum growth were found, the maximum percentage increase occurring at a pH of 6.5 to 7.0, 5.5 and 5.5 to 7.0 in three separate experiments. Differences in temperature, light intensity and length of day account for this disagreement. The reaction of the nutrient solution influenced the habit of root growth. All roots died at pH 3.5 and many of them at pH 4.0

and pH 4.5. Lateral root development was inhibited at high concentrations of both hydrogen and hydroxyl ions. [From author's summary.]

353. NICOLAISEN, N. 635.41
Die wichtigsten Spinatsorten. (**The most important varieties of spinach.**)
Züchter, 1933, 5: 1-8.

A description is given of some 18 commercial varieties of spinach received from 10 seedsmen of repute in Germany. Particulars noted in each case are colour, weight of individual plants, loss of weight after 24, 48, 72 and 96 hours, water content, leaf form both in young plants and in fully grown plants, and habit of growth, whether upright, flat or intermediate. Attempts to sow in autumn produced contradictory and unsatisfactory results. The work has done much to clear up confusion in nomenclature and to standardize varieties. The author stresses the necessity for always taking into consideration the possible modifications due to environmental factors, disease, etc.

354. DAVIES, J. LL. 635.64 + 635.63
Some aspects of consumption, supplies, and prices of tomatoes and cucumbers.
Welsh J. Agr., 1933, 9: 38-56.

The present trend of supply and demand in the industry is examined. The favourable influence of the import duties in increasing home production is noted. Figures from efficiently run nurseries show that even with the aid of the duties the profits made have been barely sufficient to pay a reasonable salary for management after allowing interest on capital. The favourable effect of high quality produce and strict grading on total cash receipts for a crop is demonstrated. It is mentioned that at present quality in tomatoes is considered only in connection with the size of the fruit and is definitely related to consumers' preferences. The uneven standardization of grade designations in tomatoes should be corrected, now that a definition of grades and standards has been issued under the National Mark Scheme. The present economic aspect of these crops as grown in Great Britain is clearly revealed in the article.

355. HACKBARTH, J., AND OTHERS. 635.64-1.523
Die Züchtung frühreifer Tomaten mittels Kreuzungen zwischen *Solanum lycopersicum* und *Solanum racemigerum*. (**Raising early ripening tomatoes by crossing *S. lycopersicum* and *S. racemigerum*.**)
Züchter, 1933, 5: 97-105.

The small-fruited *L. racemigerum* ripens 8-14 days earlier than the cultivated variety. In the F2 generation a considerable number of early ripening plants occurred but very few large fruited plants. We seem, then, to be faced with a polyfactorial limitation of large fruitedness, this being indicated also by the behaviour of the F3 generation. Observations on the period between first flowering and ripening show the existence of strong positive correlations between early flowering and early ripening, as also between size of ovary and weight of fruit. Hence selection for early ripening and weight of fruit can be made soon after the start of flowering. [From authors' summary.]

356. LINDSTROM, E. W. 635.64: 575.243
Hereditary radium-induced variations in the tomato.
J. Heredity, 1933, 24: 129-37, bibl. 5.

Methods and times of exposure for radium needles (with 12 milligrams radium) are given. Four of the six heritable, recessive variants induced arose from radiation of young growing tips and two from that of seeds. Three variants effected chlorophyll characters, two morphological characters, and one caused the sterility and stunting of the entire plant. Of the six only one proved to be identical with a natural mutation. Three at least were wholly different from any variation hitherto known in the tomato. [From author's summary.] The results due to the radium treatment shown thus and in other ways and the possible secondary causes leading to these results are discussed.

357. McDONALD, J. A. 581.084.1 : 635.64-1.454

A sensitive pot test for phosphate deficiency in soils.

Trop. Agriculture, 1933, 10 : 108-11, bibl. 8.

The tests were carried out with tomato, selected because of this plant's peculiar sensitivity to phosphate deficiency, on soils whose phosphate status had previously been determined by the Truog colorimetric chemical method. The foliar symptoms of phosphate deficiency in tomatoes are described. These being easily recognized it is thought that the plant could be used in a simple and rapid test to assess the available phosphate content of cacao soils, which has an important influence on productivity. The method outlined is as follows :—A number of soil samples from the selected area are mixed, air dried and pulverized. Four flower pots, capable of holding 9 lbs. of moist soil, are filled with this soil, to two are added 2 or 3 grams of superphosphate of lime, while two are left untreated. About 25 tomato seeds are sown in each pot, and reduced to 12 three to four days after germination. In four weeks' time the 10 healthiest from each pot are reaped and the weight of oven-dry matter determined. Indications of phosphate deficiency are dark green colour on upper side of growing leaves, violet red colour on lower sides of leaves and on the young stems, while the phosphate treated plants show a percentage increase in weight of dry matter. Additional symptoms, described by Mayer* but not observed by the author, are the upward inclination of the cotyledons and the delay of the first pair of true leaves to part at the tips. The test affords a reliable method of testing phosphate deficiency and may be particularly useful in calcareous soils of high alkalinity when chemical methods would not disclose that the phosphates present might be in a form unavailable to the plant.

358. ASAMI, Y., AND KADOTA, T. 635.646-1.542-1.84-1.547.4/5

Effects of nitrogen supply and defoliation on the growth and fruiting of the egg plant. [Japanese-English summary, 3 pp.]

Agriculture and Horticulture, 1933, 8 : 1379-98.

Experiments are reported on Shinkuro egg plants grown in soil in 9 inch pots. The soil was very low in nutrients, especially N. Results of changing the N supply and of defoliation are summarized and include the following :—N increased and defoliation decreased the growth of stems and roots. Plants in the high nitrogen and defoliation series were larger than those in the low nitrogen without defoliation series. Stem-root ratios were unaffected by treatments. Flower formation was increased by increasing the nitrogen and was not reduced by defoliation. The percentage of flowers with abortive pistils was increased by defoliation and on the undefoliated plants by low nitrogen supply, but the nitrogen supply had no such effect on defoliated plants. The percentage of fruit set from flowers with normal pistils was decreased by defoliation, but was not affected by variation in nitrogen supply. Fruit growth was increased by high nitrogen supply and reduced by defoliation. Fruit and flower production declined earlier on plants receiving low nitrogen supplies than on those receiving large amounts.

359. OORTWIJN, B. J. 633.491-1.83

De invloed van abnormale minerale bemesting op de aardappelplant. (Effect of abnormal mineral manuring on the potato plant.)

Landbouwkundig Tijdschrift, 1932, 44 : 749-61.

Starting from the results of Kok, who stated that an excess of potash may be detrimental to the quality of the potatoes and also to the total production of starch, the author describes exact field experiments by which he studied the influence of excess or deficiency of potash or phosphoric acid on the potato plant. In view of Janssen's observations, according to which plant-lice might be expected to prefer potato plants that are poor in potash, special attention was given to the susceptibility to virus diseases. An excess of phosphoric acid had no influence on the specific weight of the tuber nor on susceptibility to *Phytophthora*. Heavy potash manuring

* Mayer, L. Tomato, a sensitive and rapid indicator of phosphate deficiency in soils. *Fortsch. Landw.* 1929, 6 : 684; *Abs. J. Soc. Chem. Indus.*, 1930, 49 : 922.

increases the potash content of the tubers, and results in a low specific weight and less susceptibility to "stoot blauw" (bruise blue), a low specific weight in itself not being the cause of this higher susceptibility. The author's experiments show that the opinion of certain German workers that leaf-roll, mosaic, etc., are caused by abnormal growth conditions, is wrong. The different types of manuring have no direct influence on these virus diseases. An indirect relation may, however, exist. A late development of new shoots may be a great hindrance to the cultivation of disease-free seed plants, for it is the young shoots especially which play a part in the spreading of the virus diseases by insects. Consequently it is of prime importance to secure a rapid and strong growth and ensure that the plants do not remain green too long. V. d. L.

360. OGILVIE, L., AND MULLIGAN, B. O.

635.1/7-2.4/7

Progress report on vegetable diseases. IV.

Long Ashton Res. Sta. Ann. Rept. for 1932, 1933, pp. 103-20, bibl. 13.

Work on the following diseases is here discussed:—of asparagus: violet root rot (*Rhizoctonia Crocorum* ?=*Helicobasidium purpureum*) and *Zopfia rhizophila*; of runner beans: halo blight and wilt; of leeks: white tip disease (*Phytophthora Porri*) and a basal rot associated with a species of *Fusarium*; of lettuce: ring spot or "rust" (*Marssonina panattoniana*) and *Botrytis*; of mint: rust (*Puccinia Menthae*); of peas: pea "sickness" and foot rot involving probably *Fusarium Martii* and *Heterodera schachtii*, leaf and pod spots (*Ascochyta Pisi* and *Mycosphaerella pinodes*); of onions: *Botrytis* disease; of parsnips: "canker" due to a *Phoma* belonging to the genus *Ascochyta*; of vegetable marrows: mosaic.

361. AUSTIN, M. D., AND JARY, S. G.

635.8-2.77

Investigations on the insect and allied pests of cultivated mushrooms. I. *Sciara fenestralis* Zett.

J. South-Eastern Agr. Coll., Wye, 1933, 32: 59-62, bibl. 8.

The authors note that although this species has not apparently been recorded hitherto on mushrooms, it has in their experience often attacked this crop. They describe its life history and the damage done by the larvae, feeding either within the stalks and caps or directly on the mycelium and so preventing button formation and possibly by the introduction of mites which are found attached to the bodies of the flies. Considerable success has attended control methods consisting of spraying when the flies are first seen on the beds and thereafter every few days as necessary. The spray recommended is 10 oz. 95% to 98% pure nicotine to 100 gals. water.

362. DE JAGER, H.

632.1: 546.331.31

Ziekteverschijnselen van enkele cultuurgewassen als gevolg van de inwerking van keukenzout. (A study of sodium chloride injury on certain cultivated plants.) [English summary, 2 pp.]

N. V. Hollandia drukkerij, Baarn, 1933, pp. 95, bibl. 171.

The plants in question were wheat, rape, peas and tobacco. As regards peas and tobacco the outstanding features were that in peas the margins of the leaves became flaccid and dried up in a later phase, while tobacco leaves showed a strong bulging between the veins. The lowering of the nitrogen ratio had no effect on the detrimental effects of NaCl. The addition of calcium salts had no effect in the case of tobacco and little in that of peas. No marked copper antagonism was observed in respect to leaf symptoms in the case of tobacco. It was found that many of the following salts, using solutions of equal normality, could produce the same symptoms as NaCl:— NaNO_3 , Na_2SO_4 , KCl and CaCl_2 . In comparison with the tested ions neither the sodium nor the chlorine ion proved to be particularly harmful.

The following also are noted:—

GEHRING, A. Ueber die Bedeutung der Kalidüngung in Gemüsebau. (**The importance of potash manuring in vegetable growing.**) [English summary.] *Ernährung der Pflanze*, 1933, 29: 21-3.

- Ogilvie, L. **Ring spot or spotted wilt of tomatoes and ornamental plants.** *Long Ashton Res. Sta. Ann. Rept. for 1932, 1933*, pp. 121-2, bibl. 5.
- Horsfall, J. C., and Kertesz, Z. I. **Abnormal enlargement of peas from plants affected with root-rot.** *New York Agr. Exp. Sta., Geneva, bull. 621*, 1933, pp. 20.
- Leonard, L. T., and Dodson, W. R. **The effects of non-beneficial nodule bacteria on Austrian winter pea.** *J. Agr. Res.*, 1933, **46**: 649-63, bibl. 14.

FLOWER GROWING.

363. Beyer, J. J., and van Slogteren, E. 635.944-1.544
Vroegbloei van narcissen. (Early flowering of daffodils.)
Mededeelingen van het labor. voor bloembollenonderzoek te Lisse, No. 45, 1932, pp. 41.

The authors describe a treatment by which different varieties of daffodils can be forced into flowering about the middle of December. The plants are grown for one year in a greenhouse, the bulbs are dug at the beginning of July and are kept at 9° C. In September they are planted in boxes and kept at the same temperature. At the end of November or the beginning of December the temperature is raised to about 12½° C., and the boxes are placed in full daylight. Also with bulbs grown in the open excellent results were achieved by keeping them, after digging and drying, at a constant temperature of 9° C., even after planting in boxes. By this treatment eight varieties were forced into flowering before Christmas. The method is based on the fact that in daffodils flower formation is finished at the time of digging, which makes it possible to proceed immediately with the treatment to fit the bulbs for early flowering. A great advantage of the method is that the bulbs are forced into flowering in a very short time, often in 15 days and even less. Some directions for the practical application of the method are given. V. d. L.

364. Kearns, H. G. H., and Walton, C. L. 635.939.98-2.7
***Psila nigricornis* Meig. as a pest of chrysanthemums.**
Long Ashton Res. Sta. Ann. Rept. for 1932, 1933, pp. 95-6, and
Experiments on the control of the greenhouse symphyid (*Scutigerella*
immaculata).
Ibidem, pp. 97-101.

The authors give notes on the habits and control of these two chrysanthemum pests. For the former they advise the use of corrosive sublimate, i.e. mercuric chloride, for the latter steam sterilization of the soil, taking measures in this case to attract the pest high enough up in the soil to be killed. A combination of heating the houses and growing an attractive crop such as lettuce is suggested.

365. Brierley, P. 635.944-2.8
Studies on mosaic and related diseases of dahlia.
Contrib. Boyce Thompson Inst., 1933, **5**: 235-88, bibl. 41.

The writer has investigated a pathological condition of dahlias which has been a matter of concern to growers in the United States for some 20 years under the name of "stunt", the chief feature of which has been the dwarfing or stunting of the plants concerned. He reviews the literature on the subject and then details his own experiments and methods. Opinions have differed on the relative importance of leafhoppers, thrips, tarnished plant bugs, mosaic and cultural defects as the cause of "stunt". The writer's investigations lead him to consider that mosaic is the most serious disease of dahlias in the region surveyed. In his experiments on transfer of the virus and in most of the field tests cuttings of known varieties were used almost exclusively. Various methods of mechanical transmission having been tried in vain complete success was achieved by grafting. All members of the genus *Dahlia* tested were found susceptible, some varieties showing more tolerance of and less effect from the disease than others.

Mosaic has not been found to pass through the seed. *Myzus persicae* is shown to be a vector. The development and masking of symptoms is discussed. Selection and isolation of disease-free plants and control of aphids during the period of greenhouse propagation and roguing are suggested as a control. Other dahlia virus diseases noted are ring-spot, yellow ring-spot and oakleaf. None of the above four diseases have been connected with any other known virus diseases.

The following also is noted :—

STAPP, C. Die Gelbfäule (Gelbkrankheit) der Hyazinthen. (**Yellow rot of hyacinths** (*Pseudomonas hyacinthi*)).

Arbeiten aus der Biol. Reichsanst. Land. Forstwirtschaft, 1933, 20 : 309-24, bibl. 25.

CITRUS.

366. TORRES, J. P. 634.3-1.523
Progress report on citrus hybridization.
Philippine J. Agr., 1932, 3 : 217-29, bibl. 3.

Work was first undertaken seriously at the Tananan Citrus Station and Lamao Experiment Station, Philippine Islands, in 1931 and with the exception of a minor project in 1928 is the first citrus hybridization work to have been done in the island. Observations are made on the characteristics of certain citrus varieties from the point of view of pollination and tables are given of the crosses made and the results achieved. The improvements aimed at are:—in mandarins regular yield, good eating and keeping quality, low spreading habit, late maturity, attractive colouring, tight articulation of fruit to stem; in sweet oranges resistance to rind borer, seedlessness, good eating quality; in pummelos and grapefruits resistance to rind borer and canker, low spreading habit, seedlessness; in lemons resistance to canker and gummosis; in limes resistance to rind borer, gummosis and canker.

367. CAMP, A. F., AND OTHERS. 634.3-1.436 : 581.142
The effect of soil temperature on the germination of citrus seeds.
Amer. J. Bot., 1933, 20 : 348-57, bibl. 5.

Seeds were planted 1 inch deep in sterilized soil in 6-inch metal cans, the combined weight of each can and soil contained being the same throughout. The soil surface was covered with a 1-inch layer of granulated cork to check evaporation and insulate against loss or absorption of heat. The temperatures shown in the tables are the average temperatures for the duration of the experiment. The records taken were not really of germination but of the dates of emergence of the seedlings from the soil. The seeds of 4 species named below were tested. Considerable variation occurred in the time required for emergence within any single lot of seeds held at the same soil temperature and among different batches of seeds planted at different times. Hence it was impossible to define absolutely the minimum, maximum and optimum soil temperatures. It can be said, however, that minimum temperatures for germination of all species were probably below 15° C. (59° F.), maxima a little below 40° C. (104° F.) and optima between 31° C. and 35° C. (87.8° F. and 95° F.). Grapefruit (*C. paradisi* Macf.) and sweet orange (*C. sinensis* Osb.) appear to have slightly lower optima than sour orange (*C. Aurantium* Linn.) and rough lemon (*C. Limonia* Osb.).

368. WEBBER, H. J. 634.3-1.541.11
Variation in citrus seedlings and their relation to rootstock selection.
Hilgardia, 1932, 7 : 1 : 79, bibl. 44.

Webber gives here a very full account of experiments already reported on by him on more than one occasion, e.g. *Proc. Amer. Soc. Hort. Sci.*, 1930, 27 : 114, *H.A.*, 1931, 1 : 2 : 174. Ever since the early beginnings of agriculture propagation from the best individuals has been more or less generally practised. The results presented in this study of the selection of citrus seedlings for use as rootstocks do not approach the question of what type or species is the best stock for

a certain fruit variety on a certain soil, but furnish evidence relative to the importance of selecting the best individuals for stocks within the species or variety. Citrus seedlings used as rootstocks exhibit a wide range of variability. In any lot of seedlings of the same variety from the same source the great majority are of the same general type, but from 5 to 40% are highly variable types. The evidence available indicates that the seedlings of the prevailing type originate from apogamic embryos and are thus of the same genetic constitution as the seed parent or parents. The seedlings of variable types, termed by the author *variants*, are probably developed from normally produced sexual embryos and are present in small numbers in nearly every lot of citrus seedlings. These variant seedlings are usually small and lacking in vigour and it is chiefly with their effect on the uniformity of the orchard that the paper deals. The greater part of the paper describes the results obtained from a study of 389 trees of Washington Navel orange on sour orange stocks. Among these stocks were 43 seedlings of variant types. These were themselves budded on to sour orange and rough lemon stocks and found to maintain their distinctive varietal characteristics. These variant stocks were later found to cause marked dwarfing of the orchard trees budded on them. Comparing the size of the nursery seedlings with the size of the 1-year-old trees (or budlings) and subsequently with that of 8-year-old trees in the orchard, a marked positive correlation was established. This, however, was greatly reduced when the trees budded on variant rootstocks were excluded, and the uniformity in size of the remainder correspondingly increased. The trees tended to become more uniform in size as they grew older. [The coefficients of variability for trunk cross section obtained approximate very nearly to those found for apple trees on vegetatively raised rootstocks.—Abstractor.] Comparing stock size and 8 years' yield, there was again a positive correlation, which was reduced when the variant types were included. Nevertheless, there still remained some tendency for the bigger seedlings of the prevailing type to produce the larger and more heavy yielding trees. Tree size in these experiments was expressed by measurements of trunk cross-sectional area and volume of the top. These conclusions were confirmed by observations on a population of 1,506 Washington Navel trees on sweet orange and in a commercial orchard. As a result of his observations the author recommends selection in the nursery at three periods:— (1) The discarding of the smallest seedlings to the extent of about one-fourth on removal from seed bed. (2) The elimination firstly of all variant seedlings irrespective of size, just prior to budding; and at the same time small seedlings to the extent of about one-fourth of the remainder. (3) The discarding of inferior budlings before orchard plantings. These should not amount to more than about 5%. T.N.H.

369. PROVAN, J. L.

634.3-1.541.11

Root stocks of citrus trees.*J. Dept. Agr. Victoria* (Australia), 1933, **31** : 266-70, bibl. 4.

The article calls attention to the loss or poor condition of many citrus trees in Victoria due to incompatibility in soil and in stock-scion relationships. Instances of stock-scion incompatibility quoted are Satsuma on sour orange, Eureka lemon on trifoliate, Maltese blood orange on rough lemon, this latter combination resulting on all soil types in small stunted tops with the rootstock constantly producing large vigorous shoots just below the union. Partial incompatibility, the stock outgrowing the scion, is found in mandarin on trifoliate, though apart from this the trees grow well and bear good quality fruit in plenty. Delayed incompatibility is shown by Early Imperial mandarin on rough lemon. Perfect compatibility is found with Valencia Late orange on sweet orange and Washington Navel on both sweet and sour stock. Rough lemon is a useful stock for sweet orange in non-irrigated areas owing to its ability to withstand drought. On Victoria loam under irrigation a period of vigorous growth is succeeded after the 15th year by a gradual deterioration, which imperfect drainage proportionately hastens. Sour orange stock would resist these conditions. Sour orange is resistant but not immune to collar rot, its degree of resistance being in fact influenced by the susceptibility or otherwise of its scion. Thus when carrying lemons or Washington Navels its susceptibility is greater than when the scion is Valencia Late. Often, however, the scion will develop collar rot while the stock remains immune. This is particularly noticeable in cases of too deep planting. Instances of rootstock influencing

fruit quality and maturity are given. Thompson's Improved Navel orange was 16% lower in acidity on rough lemon than on sweet orange, had a thicker rind, and ripened 2 to 4 weeks earlier. Sometimes fruit quality on rough lemon improves as the tree grows older. Allusion is made to the methods of rootstock selection by severe roguing in the seed and nursery beds of variants and undersized plants as advocated by Webber.* It is not impossible that strains of sour orange might be found which respond better than others to a given scion. In conclusion the need for experiment and trial under local conditions is pointed out.

370. FRIEND, W. H. AND CLARK, S. W. 634.3
Citrus orchard management in the Lower Rio Grande Valley.

Texas Agr. Exp. Sta. circ., 67, 1933, pp. 56, bibl. 16.

This is a short manual of the best citrus practice in this now firmly established citrus growing district of Texas. The author deals with all ordinary cultural practices and with suitable varieties for planting of the following fruits:—grapefruit, oranges, tangerines, frost-hardy lemons such as the Meyer, tangelos, limes. He notes that the calamondin is of interest chiefly as a rootstock plant for special varieties, as a windbreak and as a juice fruit for use in place of limes and lemons. Insect pests and diseases are dealt with by the second author. The article ends with a calendar of orchard management.

371. ANON. 634.3-1.67
Saving in irrigation water.

Hadar, 1933, 6 : 135. (From *Californian Cultivator*, undated.—ED.)

Records are given of irrigation investigation in a Californian citrus grove made by Dr. Samuels of the Soils Laboratory, Covina. The control block received the customary 9 irrigations per annum using 4,815 cubic metres of water per acre. In the experimental plot the wilting point was determined, and the soil moisture content was taken at regular and frequent intervals until an accurate picture of the soil moisture conditions throughout the rooting zone of the trees was obtained. Irrigation was based on the amount found to be best for the optimum growth and yield of the trees. This resulted in 7 irrigations only instead of 9 and a reduction of the amount of water per acre to 3,655 cubic metres. This substantial saving in labour and water costs was accompanied by a marked improvement in the condition of the trees. It is also remarked that heavy irrigations tend to wash manures and plant foods below the reach of the roots.

372. WILLIAMS, W. H. 634.3-1.67
Precautionary measures in citrus irrigation.

Hadar, 1933, 6 : 131. (From *Californian Cultivator*, undated.—ED.)

It is pointed out that because a particular system of irrigation has been successful over a period of years it does not follow that it will always be suitable. Unless this fact is recognized and a watch kept for unfavourable symptoms, damage may be caused to the orchard which it will take years to repair. Causes likely to necessitate a change in irrigation are an increase through growth of the leaf area, or a decrease in leaf area from a number of causes among which are mentioned storm and pest or frost injury or heavy pruning. Examination of the soil should be made to a depth of 2 or 3 feet into the root zone. Surface examination tells little. In soils, where the root system is well distributed in depth, 12-15 inches of soil may be allowed to dry out, on the assumption that 60-70% of the roots, the supposed minimum required by the tree for normal functioning, would still be in the moister zones below. In shallow soils, where the rooting is necessarily nearer the surface, the drying out should not proceed below 9 inches. The dangers of over-irrigation and consequent waterlogging are explained. Waterlogging, a result of former over-irrigation on heavy soils, has been checked by the action of vigorously growing cover crops, which are reaped and replaced as their vigour declines, as often as four

* Webber, H. J. Selection of stocks in citrus propagation. *Univ. Calif. Agr. Exp. Sta. bull.* 317, 1920. [Twelve years later Webber's recommendations remain practically unchanged. His actual methods of selection are described in *Hilgardia*, 1932, 7 : 1-79 and are summarized in *Technical Communication* No. 3, 1932, Imperial Bureau of Fruit Production, East Malling, p. 7. See also No. 368 of this issue.—ED.]

times a year. Suggestions for methods of reduced irrigation are made, for instance alternate sides of the tree could be watered in 3 furrow runs every 3 weeks, the nearest furrow being 3½ ft. from the trunk, instead of the whole grove being watered monthly, which would mean the soil drying for 6 weeks and the trees receiving water every 3 weeks.

373. MILLER, R. L., AND OTHERS. 631.821 : 634.31
Effect of lime (calcium hydroxide) on the composition of Conner, Valencia and Satsuma oranges.
Citrus Industry, 1933, 14 : 4 : 7, 22, bibl. 1.

The paper summarizes the results of three independent investigations in Florida and Alabama of the effect on orange fruit of concentrations of lime such as are used in spray insecticides. In Orlando, Florida, 2½ lbs. of hydrated lime per 50 galls. of water sprayed on Conner orange trees in June had no effect on the respiration or catalase activity of the leaves, or on the fruit composition. Considerable lime was found by analysis to be present on the leaves during the growing season. Four applications of 20 lbs. of lime per 100 gals. water made monthly from May to August had no effect on the fruit composition of Valencias at Lake Alfred, Florida. Two applications, 20 lbs. of lime per 100 gals. of water, made in June and September, caused no change in fruit composition or maturity of Satsuma oranges at Spring Hill, Alabama.

374. WINSTON, J. R. 664.85.3 : 632.1/4
Some factors influencing decay in Florida citrus fruits.
Citrus Industry, 1933, 14 : 5 : 20, 24.

Florida citrus fruit is subject to decay by four major organisms of which two, blue and green mould, are common to other sections of the U.S. and easy to suppress, while the other two, the stem end rots, are particularly prevalent in Florida. *Pre-harvest factors*. 1. Dead wood in the trees. This is the only known source of infection of fungi causing both forms of stem end rot. 2. Maturity at harvest. Contrary to popular belief, fruit harvested early decays much more slowly than that harvested later. 3. Fruit sprayed with less volatile types of oil within a month of picking requires longer time in the colouring room. The extra time increases decay. 4. Excessive use of ammoniate fertilizers produces fruit which bruises and decays easily. 5. Fertilizer treatments for early and mid-crops are probably not suitable for late crops. The latter are on the tree during reduced vegetative growth. If this growth is stimulated, the green pigments in the fruit rind also take on fresh life. A regreened fruit is very difficult to colour, and means a longer time in the colouring room and increased liability to decay. 6. Cultural practices tending to produce coarse thick-skinned fruit. This type also is difficult to colour. Contributing factors to the production of coarse fruit are said to be excessive use of complete fertilizers, of ammoniates, of irrigation, of heavy leguminous cover crops annually over a period of years. Fruit on rough lemon rootstock is particularly susceptible. *Harvesting and post-harvest factors*. 1. Careless clipping, over-filling field boxes. 2. Neglect to use borax in the washing operation. In this connection it is noted that a borax bath before colouring is much more effective in preventing stem end rot than if the bath is deferred till after colouring. 3. Careless treatment in the colouring room. 4. Delay between picking and pre-cooling.

375. PLANK, J. E., V.D. 634.31-2.4
Sooty blotch on citrus.
Farming in S. Africa, 1933, 8 : 195, 197.

The blemish known as sooty blotch is caused by the dark hyphal threads of the fungus *Gloeodes pomigena* Colby growing on the surface of the orange. It does not penetrate the skin. The blemish can be removed by dipping for from 50-60 seconds in good commercial bleaching powders containing 33% available chlorine, used at a strength of ½ lb. to a gallon of water. Bleaching takes place during exposure to the air after dipping. The fruit is then thoroughly washed by dipping into water. If this precaution is omitted, the fruit may develop sunken spots.

376. LINDERMAN, R. H.
A spray programme for citrus trees.
Citrus Industry, 1933, 14 : 5 : 6.

634.3-2.95

This spraying programme, in force at Mountain Lake, Florida, is claimed to have reduced scale to such an extent that oil spray is no longer necessary, to have reduced melanose below the degree prevalent in neighbouring orchards and to have greatly improved the colour and texture of the fruit. It consists first of lime-sulphur 1 : 25 applied about mid-January for grapefruit and 1 : 40 for oranges. This first spray achieves a considerable control over scab. Dry lime-sulphur is also used, 2 lbs. equalling 1 gal. solution. The second application is made at 1 : 40 when three-fourths of the blossom has fallen. Thereafter general applications at 1 : 40 are made at 7-week intervals throughout the summer until September 1st. One further application will keep the fruit in condition till harvesting. The July application is made at a time when the young scale insects are most active. The spray is applied with a pressure of 400-500 lbs.

377. CLAUSEN, C. P.
The citrus insects of tropical Asia.

634.3-2.7

United States Dept. Agr. circ. 266, 1933, pp. 35, bibl. 25.

This article contains information gleaned partly from personal experience in Malaya, Java and Sumatra, partly from literature available only in the larger libraries. In the United States the most serious insect pests are restricted to the *Coccidae* and the *Aleurodidae*, but in Asia these do not hold so important a position. Among insects noted either for general destructiveness or extreme destructiveness over a limited area are, as regards the fruit, a fruit fly *Chaetodacus ferrugineus* var. *dorsalis* under the sub-tropical conditions of Taiwan and the lepidopterous fruit borer, *Citripestis sagittiferella*. The most important foliage feeder is the beetle, *Hypomeces squamosus*. Three species of leaf miner are known. Scale insects are numerous but no one species is present in a uniform and destructive status over a large area. Of these, *Pulvinaria polygonata* and *Coccus viridis* are sometimes completely wiped out by a fungus. Of the *Aleurodidae*, *Aleurocanthus spiniferus* and *A. citripedus* give trouble in different parts, but *A. woglumi* is only a minor pest. *Agrilus occipitalis* among the bark, twig and trunk borers ranks as a major pest in the Philippines.

The following also is noted :—

TANAKA, T. **A criticism on Rumphius' Citrus.** [Descriptions in Japanese.]
J. Hort. Assoc. Japan, 1933, 4 : 2 : 1-8, bibl. in text.

TROPICAL CROPS.

378. LEAKE, H. M.
Studies in tropical land tenure.
Trop. Agriculture, 1933, 10 : 111-13, 126-31, 155-60, bibl. 21.

333.5

This series* which has now discussed individually the land tenure systems of all the tropical countries in the Empire is brought to a conclusion with articles on Mauritius and the Sudan. A final summary (pp. 155-60) points out the extraordinary diversity of the different systems and examines their relative degrees of effectiveness in realizing the potential agricultural wealth of a country and securing it to that country's benefit.

379. CARTON, P.
Importance des facteurs écologiques, durée du jour et intensité de la lumière en agronomie tropicale. (Importance of the ecological factors, length of day and intensity of light in tropical agriculture.)
L'Agronomie Coloniale, 1933, 22 : 183 : 87-91 ; 184 : 120-6 ; 185 : 149-55 ; 186 : 182-6, bibl. 12.

581.5

A summary of present knowledge on the subject. Many experiments are quoted. To take an example, experiments on a number of crops such as rice, maize, *Commelina benghalensis* L.,

* See *H.A.*, 1932, 2 : 4 : 375, and 1933, 3 : 1 : 93 and 3 : 2 : 225.

Alternanthera versicolor Regel and *Brassica juncea* L., a mustard, showed that all were definitely retarded by diffused light as compared with full sunlight, but *Commelina* and *Alternanthera* less so than the others. Morning sunlight had a more favourable effect than that of the afternoon. Rice, maize and mustard produced a greater quantity of dry matter when exposed only to morning sunlight than when growing for double the length of time in diffused light.

380. JONES, G. A. 63(72.9)
Recent agricultural developments in some of the Leeward and Windward Islands.

Proc. Agr. Soc. Trinidad and Tobago, 1933, 33 : 168-80.

The paper gives a concise survey of the present agricultural and economic situation, the problems involved and the way in which they are being approached in the West Indian islands of St. Vincent, St. Lucia, Dominica, Montserrat, Antigua and St. Kitts.

381. PARSONS, T. H. 631.534/535
Vegetative propagation.
Trop. Agriculturist, 1933, 80 : 359-61.

Various methods of propagation by cuttings, marcotting (gooteeing), layering, inarching and grafting under tropical conditions are described. An ingenious method of keeping the bandage around a marcotted branch moist in dry weather with little attention is illustrated. A section of bamboo filled with water is suspended above the marcot. The bottom of the bamboo is pierced to admit a thick string, the other end of which is wrapped round the bandage. The water in the bamboo slowly but continuously passes down the string ensuring a constant supply of moisture to the part under treatment.

382. ROMAGNOLI, M. 631.874
La copertura vegetale verde del terreno in paesi tropicali. (Green manures and cover crops in the tropics.)*
L'Agricoltura Coloniale, 1933, 27 : 232-8.

A brief account is given of the different plants tested for their usefulness as cover crops or green manures for different crops including rubber, tea, coffee, cacao, coconuts, oil palms, quinine, agave. The places where trials have taken place are noted and indications made of the species which have so far proved satisfactory for use under particular commercial crops. Because of the great number of plants mentioned it is impossible to give details here, but a full translation can be supplied by the Bureau if required.

383. EDWARDS, W. H. 632.796
The damage caused by ants† in seed beds and garden and how to control the pest.
J. Jamaica Agr. Soc., 1933, 37 : 187-9.

The following methods for the destruction of ants and their nests are recommended by the author, Government Entomologist in Jamaica, as being simple and effective. In situations devoid of plants boiling water may be poured into the nest, or a solution of cyanide of potassium 1 oz., water 1 gal. An effective formula harmless to plant life is hard soap 75 gms., kerosene 1 litre, water $\frac{1}{2}$ litre, creoline, crude carbolic acid or Jeyes' Fluid $\frac{3}{4}$ litre. The soap is first dissolved in boiling water, the kerosene is then gradually added and the mixture stirred till emulsified. The creoline or substitute is added and well mixed. The stock emulsion thus formed will keep indefinitely and is used at the rate of 1 part to 50 of water on lawns or strong plants and 1 part to 100 of water on seed beds. When applying any liquid insecticide to a nest the liquid should be first poured round the periphery of the nest until the ground is soaked in order to block the exits. The centre of the nest can then be treated. Destruction of nests by fumigation

* Translation available.

† See also 347.

can be effected with carbon bisulphide placed in holes round the nest, 1 tablespoonful per hole, and then covered. The holes should be 8-12 inches deep and the same distance apart; or instead half a teaspoonful of calcium cyanide can be used per hole in the same manner. A long lasting non-poisonous repellant for painting posts supporting seed boxes is made by dissolving 2 lbs. rosin in 2 litres of boiling castor oil and raw linseed oil mixed in equal parts. After boiling, air is blown through the liquid to cool it to atmospheric temperature and it is then painted on the posts in bands 3-4 inches wide.

384. FREISE, F. W. 633.5
 Brasilien als Erzeuger von Faserpflanzen (ausser Baumwolle). (Brazil as
 producer of fibre plants other than cotton.)
Tropenpflanzer, 1933, 36 : 60-5.

Attempts have recently been started to grow commercially *Piteira gigante* (*Fourcroya gigantea* or *Agave foetida* L.), a plant belonging to the *Amaryllidaceae*. The wild plants yield 25 to 30 usable leaves, each 1.6 to 2.2 m. in length and 2 to 2.6 kg. in weight, while the cultivated ones yield 40 to 50 leaves of smaller measurements. A calcareous soil rich in mineral matter seems preferable. Some 630 to 640 plants can be grown on 1 acre and these should begin to produce leaves ripe for cutting in the third to fourth year. Each leaf with careful handling will yield 45-68 grammes fibre, though 30 to 35 grammes may be considered average, making 30,000 leaves necessary for the production of a ton of fibre. Good fibres are used for oil press cloths, fish nets and ropes. Two other plants belonging to the *Bromeliaceae* yielding fibres are *Ananas bracteatus* and *Bromelia Karatas*, though no attempt has been as yet made to grow and sell these on a commercial scale. *Urena lobata* of the *Malvaceae* is a plant, with the fibres of which it is hoped to replace imported jute. An acre will produce from 640 to 710 lbs. of fibres which resemble flax. No use has yet been found for the seed oil. It will grow well in a temperate climate and seems to be very tolerant of different types of soil. It shows preference for low lands or seaboard. *Musa humilis* yields fibres which are tough, flexible, and very indifferent to such environmental conditions as heat and cold, drought and humidity. They are used for press and filter cloths in the plant oil industry.

385. PARSONS, T. H. 633.68
 Food crops of the tropics.
Trop. Agriculturist, 1933, 80 : 285-9.

The history and the best methods of cultivation of the breadfruit (*Artocarpus incisa*) and the jak fruit (*Artocarpus integra*) are dealt with.

386. VAN DER POEL, J. 633.71:1.531
 Moeilijkheden op tabaks-zaadbedden. (Tobacco seedbed difficulties.) [Eng-
 lish summary.]
De Indische Culturen (Teysmannia), 1932, 17 : 381-90, 409-11, 437-41.

Results summarized are as follows:—1. It is essential for good germination in sandy seedbeds that coarse particles should not predominate. 2. For proper germination and good growth in loamy seedbeds the soil should not be one in which the finest particles predominate, while germination is even worse if coarse particles predominate. 3. If the loam used is too fine, the roots from tobacco seed cannot penetrate the ground and remain uncovered and so dry up. The use of coarse sand leads to the washing away and decay of many of the seeds. 4. Seedlings grow more quickly in sandy than in loamy seedbeds. 5. When bad germination is caused by coarse sand, this condition can be remedied by covering the seedbed with a thin layer of not too coarse sand, or of not too fine loam. 6. For the first 20 days after sowing germination and growth of tobacco seedlings are influenced only by the top one-third inch layer of the soil.

V. d. L.

387. JOCHEMS, S. C. J. 633.71-2.314
 Toprot en rotstelen bij Deli-tabak. (*Stem-rot of curing tobacco and hollow-stalk in Sumatra.*)

De Indische Culturen (Teysmannia), 1932, 17: 465-70, 492-5, 520-24, 548-50.

The author summarizes his article as follows:—Hollowstalk is a disease in Sumatra tobacco which under certain circumstances may be very serious. The symptoms are identical with those which are described in other tobacco districts (J. Johnson, Nakata, Anderson and Clinton, Hopkins, Hornby). A bacterium was isolated which, as shown by inoculations, caused "hollow-stalk" infection. This has been identified by Prof. Nakata as *Bact. aroideae* Townsend. The most important of various kinds of rot which appear in tobacco in the drying shed is stem-rot. This is a wet rot which attacks the midrib and large veins of green tobacco leaves immediately after they have been hung up to cure. In cases where it is very bad the veins become so weak that many leaves drop from the string on which they are hanging. The bacterium which causes this rot appears to be also *B. aroideae*. Cross-inoculations gave decisive proof of this. It is probable that stem-rot is brought into the drying sheds by leaves picked from plants infected with hollow-stalk. Special experiments showed that the use of infected stringing needles and string might be the cause of this sickness being transferred to a great number of leaves. Spreading of hollow-stalk can be avoided by refraining from topping the infected plants, when conditions are favourable for the disease. In order to minimize stem-rot no leaves should be picked from hollow-stalk plants, whilst especial care should be taken that there is good ventilation in the drying sheds when the weather is favourable for the spread of the disease. The leaves should be hung in such a way that as much as possible of the tobacco gets good ventilation. During the night ventilation can be promoted by lighting fires.

Under very damp conditions tobacco wilt (*Bact. solanacearum*) may appear in a very atypical form. Instead of a slow withering in an upward direction coupled with necrosis of parts of the surface of the stalk, the pith of the stem rots completely until finally the top breaks off. Necrosis seldom appears externally. On the surface of the leaves of such plants the midribs are slightly rotted at the place where the leaf joins the stem. In practice such leaves are considered to be the beginning of stem-rot. Experiments show, however, that this disease only results on those leaves of atypical wilted plants in the drying sheds under conditions of extreme moisture. Further experiments proved that generally such leaves cured quite normally in the drying sheds.

V. d. L.

388. WELLENSIEK, S. J. 633.72-1.521
 Kweekerijselectie bij thee door beoordeelend op het oog. (*Tea selection in the nursery by eye.*) [English summary, 1 page.]
Archief v. d. Theecultuur in Ned. Ind., 1932, 6: 123-32, bibl. 3.

The object of the experiment was to discover whether selection of the nursery tea plants with the strongest vegetative habit (and presumably therefore the highest potential yield) could be done as effectively by eye as by the current, tedious methods of weighing the branches and leaves derived from cutting the plants at a level of 15 cm., or by measuring the diameter of the trunk. Selection by height seems to interfere with selection for low branching. Six persons selected by eye out of 5 groups of 100 plants the heaviest 10 and the next heaviest 10. In weight of vegetation and diameter of stem 75% were correctly selected and the remaining 25% fell into the next 10 or best 20%. Selection by height was less satisfactory, but height is not a suitable character for selection for yield. There was a positive correlation between weight of stem and branches and weight of roots. Comparing these results with those in an analogous investigation* it is concluded that positive selection by eye in small groups is much easier than contra-selection in large groups.

* Wellensiek, S. J. Selectieve uitdunning bij thee. (Selective thinning of tea.) *Bergcultures*, 1932, 6: 225-228, *H.A.*, 1932, 2: 4: 382.—ED.

389. WELLENSIEK, S. J. 633.72-1.535-1.55
 Productiebepalingen bij thee-klonen. (Yield determinations of tea clones.)
 [English summary, three-quarters page.]
Archief v. d. Theecultuur in Ned. Ind., 1932, 6 : 133-43, bibl. 5.

The correlation coefficients between the yield of certain parent trees and the average yield of their vegetatively propagated offspring amount to $+0.289 \pm 0.165$ and $+0.214 \pm 0.092$ respectively in two groups on the Pasir Enti Estate, Java. Thus some agreement between mother trees and clones would seem to be indicated, though the material available for comparison was too scanty for a definite pronouncement. In testing a number of different clones it was found that the variability of yield in 8 pluckings amounted to 40%. This amount of variation according to Ostendorff (*Bergcultures*, 1932, 6 : 627-28) requires the testing of 55-60 individuals per clone to reveal a difference of 10%. For a difference of 25%, 16 individuals would be enough.

390. TUBBS, F. R. 633.72-1.542
 Recovery from pruning.
Tea Quarterly, 1933, 6 : 11-24.

A comparison is made of three methods of tea pruning in Ceylon. The aspects discussed were the effects of the pruning methods in connection with the time at which the operation is performed, the elevation of the estate and the recovery of the bush from pruning. The effect on yield was not considered. The methods selected for investigation were (1) the clean prune in which the frame-forming branches are cut to 3 ins. above the previous level, nearly all the smaller branches being removed, (2) the cut across, at the same level, nothing but diseased wood being removed below pruning level, (3) rim lung pruning which is clean pruning at the same level as the others, but 6 branches are left on the circumference to act as lungs until 10 days before tipping. From the data collected it is considered that the light rim lung pruning is the most suitable for low elevations, since it leaves a large proportion of leaf on the bush yet allows of a thorough cleaning out of dead wood. At St. Coombs Experiment Station pruning at different times did not have any effect on the growth rate. The type of pruning showed much quicker growth on the part of the "cut across" bushes, there was however some evidence to show that the relative rates of growth between the three methods varied with the season at which the pruning was performed. The effect of elevation on growth seemed to be as follows. At St. Coombs (alt. 4,500 ft.) bushes pruned by the cut across method grew the fastest, with clean and rim being second and third. At Peradeniya (alt. 1,500 ft.) the order was cut across, rim lung and clean, the first two not differing significantly. At Galatura (alt. 200 ft.) rim lung was definitely the fastest, followed by clean cut and cut across in that order.

391. HOLLAND, T. H., AND JOACHIM, A. W. R. 631.459 : 633.72
 A soil erosion experiment.
Trop. Agriculturist, 1933, 80 : 199-207.

The objects of the experiment were to ascertain (a) the amount of erosion on steep tea land, (b) the value of *Indigofera endecaphylla* as cover or *Clitoria cajanifolia* as contour hedges in checking erosion. Actual recording began from June 1st, 1926. The experimental plot were constructed as follows :—Six parallel adjoining plots, 96 ft. long and 15 ft. across, running down a slope of 29° - 31° , were separated from each other by brick down-drains 2 ft. wide having an outer wall of sufficient height to prevent intrusion of earth from neighbouring plots. Each plot was traversed by 5 contour drains leading into the down-drains. A brick retaining wall at the top of each plot prevented the entrance of soil from the slopes above. At the foot of each plot was a pit 15 ft. long, 2 ft. 3 ins. wide and 3 ft. 6 ins. deep. All soil washed off each plot, either directly or down the drains, entered and was retained in these pits. The plots each contained from 55-63 tea bushes interplanted with from 4-6 *Gliricidia* as shade per plot. Recording was done by siphoning at intervals the water accumulated in the pits into graduated, cement measuring tanks. The total of dry matter in suspension in this liquid was determined from measured samples for each plot, and the tanks then emptied by means of drainage plugs. The solid deposit accumulating at the bottom of the pits was determined for dry matter content twice

annually. Thus a complete record of the weight of dry soil eroded from each plot was obtained. This amounted in 6 years to 101·8 tons per acre, or 17 tons per acre per annum, from two control plots, unplanted with cover crops. On two plots planted all over with *Indigofera endecaphylla* the loss for the period was 56·7 tons or 9½ tons per acre per annum, and from two plots planted above each drain with a thick hedge of *Clitoria cajanifolia* 92·4 tons or 15½ tons per acre per annum. The *Indigofera* plots showed at the end of the 4 years large increases in nitrogen and organic matter, whereas the controls showed decreases. *Clitoria* plots showed slightly increased nitrogen. Loss in clay and gains in sand and gravel were common to all plots, the smallest loss and gain being shown by the *Indigofera* plots, the largest by the controls. Eroded soil material was richer in fertilizing constituents than the soil from which it was washed. Percentages of potash, phosphoric acid and nitrogen were lowest in the controls and highest in the *Indigofera* plots. Based on the figures obtained it is shown that there is an average yearly loss from these soils of about 71 lbs. of nitrogen, 67 lbs. of potash and 27 lbs. of phosphoric acid.

392. SLADDEN, G. E.

633.73

Le jardin semencier de Bangelan. (**The Bangelan seed garden.**)*Bulletin agricole du Congo belge*, 1933, 24 : 3-44.

A very complete account of the well-known coffee selection and breeding Experiment Station at Bangelan, Java. The whole work of this station is fully described in the article, but it is only possible here to allude to a few of its many aspects. In grafting coffee there the cleft graft is employed. The stock, of pencil thickness, is cut just above the junction of the new green and the older suberized part of the stem, this exact spot having been shown to give the greatest number of successes. The beds containing the seedling stocks to be worked are heavily watered two days before and receive no more water for four or five days. Success depends very largely on the weather, abnormal rain or drought always resulting in heavy losses. Ninety-eight per cent. success is expected in the nursery and 90-95% when the grafting takes place in the field. The trained grafters average 120 grafts a day. Some strong growing coffee varieties require to be planted 20 ft. apart. Since they will not need this entire space for 8 or 10 years, a temporary interplanting at 10 ft. is made of some small growing, quick bearing variety. The ground cover and shade crops system usually adopted is parallel lines of *Crotalaria anagyroides* on each side of the tree and 45 cm. from it running across the slope of the hillside, a planting of *Indigofera endecaphylla* to fill the vacant spaces not occupied by the other crops. On the edge of each terrace is a hedge of *Leucaena glauca*, kept trimmed to 30 cm., and at regular intervals of from 3-6 m. according to size, a full grown *Leucaena glauca* providing adequate shade. Various other arrangements and combinations of cover crops are being tried. In cultivation selective weeding is practised and only definitely harmful plants are removed. Various systems of pruning are described and the author remarks that it is extraordinary that so little experimental work has anywhere been done on an operation of such vital importance to coffee. Old trees may be successfully renovated by being cut back to within 30-40 cm. of the ground. A preliminary saw cut is made at this height in July which causes the formation of buds below it. The final heading back is done in November. Of the suckers that result, a strong shoot, not too near the top on account of possible necrosis of the stump, is selected to form the new head. In two years the tree is again bearing. Less than 5% of trees are lost at Bangelan in the practice of this method. In the selection of seed for sowing only the large berries are used. The harvesting and preparation of the coffee for marketing are also described. Throughout the article the costs of every operation are given.

393. DUARTE, C.

633.74

Contribution à l'étude des cacaos de Timor. (**Cacao varieties of Timor.**)*Anais do Instituto Superior de Agronomia*, 1932, 5 : 2 : 243-54.

The cacao cultivation of the Portuguese division of the island of Timor is surveyed. The methods in use are found to be antiquated and uneconomic. It is recommended that a small experiment station should be established on the lines of the cacao experiment station at Barumbu in the Belgian Congo, where a careful study of cacao problems is made under conditions somewhat

similar to those at Timor. It is further suggested that the necessary shade for the cacao should be supplied by the oil palm, *Elaeis guineensis*, since in addition to its shade the economic value of this plant is considerable. Samples of four different types of dried Timor cacao bean were examined and are described.

394. HARDY, F. 633.74

The chemical programme of 1932.

Second Ann. Rept. on Cacao Research for 1932, I.C.T.A., Trinidad, 1933, pp. i-ii.

The following investigations are reported by the Chemical and Ecological Section:—(1) an environmental study of the cacao tree; (2) a soil survey; (3) phosphate status of the cacao soils of Trinidad, Tobago and Grenada; (4) the nitrogen status of these soils; (5) the relationship between the chemical composition of cacao leaves and beans, and environmental growth conditions, including the general nutrient status of the soil. Mention must be made of the series of coloured plates illustrating the eleven pod colour classes now to be used in conjunction with pod forms (illustrated in half-tone) in an attempt to create an efficient standardized classification, hitherto lacking, of the assortment of types comprising the "Trinitario" group of Forastero cacao. The accurate manner in which the fine colour gradations between one class and the next are brought out reflects the greatest credit both on the artist and the printer. [The papers dealing with the above are abstracted separately in this number of *H.A.*—Ed.]

395. POUND, F. J. 633.74-1.52

Criteria and methods of selection in cacao.

Second Ann. Rept. on Cacao Research for 1932, I.C.T.A., Trinidad, 1933, pp. 27-9, bibl. 3.

Here the aim of selection is increased yield with improvement of quality as a secondary desideratum. As yield means yield per acre rather than yield per tree, the records should be corrected to allow for the area occupied by the tree. Since this is difficult to do with accuracy, the yield per tree is used as the basis of selection, but the age or size of the tree is kept in mind. The yield of a tree is estimated from the product of the number of pods it produces over a period of years and the average wet weight of cacao per pod. First selections are made on pod value, thus leaving only a relatively small number of provisionally selected trees to undergo the more expensive process of pod counts, reducing the error introduced by the age factor and allowing of an automatic selection for quality without prejudice to yield. To explain this latter point it is noted that the higher cacao content of large pods is due to their containing not more, but larger beans than the smaller pods, thus reducing labour costs of picking and breaking while producing a better quality cacao. Figures taken from the extremes of the crop show that 50 of the largest pods may be worth more than 200 of the smallest. The criterion for first selections in Trinidad is 7.5 pods to the pound of dry cacao, or 150 grams of wet cacao per pod. This test will eliminate all but 2% of the trees on good estates. Since high pod value and heavy bearing have been shown to exist in combination* in some trees, there is little danger that selecting for large pods will eliminate all the heavy bearers.

The technique, which it is hoped will allow of the examination of 50,000 trees in one season, consists of a preliminary selection by eye, followed by a quantitative survey of the survivors with a slight sacrifice of precision for the sake of speed. In this second test the pod contents are rapidly weighed on a special spring balance "calibrated to show simultaneously the weight of wet cacao in grams and the number of similar pods which will give a pound of dry cacao, assuming a loss of 60% in fermentation and drying". An adequate sample is 30 pods per tree. The trees finally selected will number about 1,000 and these will be observed for yield, which in the course of a few years should reduce their numbers to manageable proportions. The minimum yield of pods has been fixed at 50 for a fully grown tree requiring $7\frac{1}{2}$ pods to the lb., and yielding 8 lbs. of high class cacao, and 25 for trees 10 to 15 years old. A small selection of trees requiring more

* *Ibidem*, 1931. The genetic constitution of the cacao crop—pp. 10-24, and 1932, 9-25.

than $7\frac{1}{2}$ pods to the lb. of dry cacao is also being made and it has been provisionally decided that those trees may be classed as equally efficient with the above which produce 10 lbs. of cacao at the rate of 10 pods to the lb., or 12 lbs. of cacao at the rate of 12 pods to the lb. Although it is almost certain that because of the extra cost of picking and the number of pods requiring manipulation to produce 1 lb. of cacao the heaviest bearing trees are not the most profitable, in view of their value in research an independent selection is being made of all trees reputed to bear more than 300 pods per annum. Selected trees will as far as possible be at once propagated vegetatively into small clonal groups which will provide the material for future propagation studies. The facts related here have given a clearer idea than has hitherto prevailed of the potentialities of the crop and it is emphasized that future plantings should always be made from material selected on the principles outlined, and although at present seed grown plants alone may be available, they will at least represent the best that is obtainable. The possibility of a correlation between age of tree and size of pod has not been overlooked and is to be tested statistically as far as is possible where the exact age of the older trees must usually be in doubt.

396. POUND, F. J. 633.74 : 575.1
The genetic constitution of the cacao crop.
First Ann. Rept. on Cacao Research for 1931, I.C.T.A., Trinidad, 1932, pp. 10-24, bibl. 1, and *Second Ann. Rept. on Cacao Research for 1932, 1933*, pp. 9-25, bibl. 3.

The results and methods of a quantitative and qualitative survey of a representative sample of Trinidad cacao are described. The first experimental material consisted of 3 blocks of 100 trees each, situated on estates in different valleys in the Northern range of Trinidad. The characters chosen for observation, all precisely measurable, are as follows:—number, weight, length and diameter of pod, thickness of pod shell, weight and number of beans per pod. Qualitative notes on pod type and cotyledon colour were added. A standard sample of 30 pods per tree was found to give means within 5% of the true mean for pod length and diameter, and within 10% for shell thickness, bean number and wet cacao weight. Samples of branch pods gave lower means than samples of trunk pods. Examining the effects of increasing dryness of the weather it was found that samples taken during the month of maximum bearing will give mean values very close to those for the whole crop. Two quite different climatic seasons did not affect the measurements within the limits of precision required for practical selection. The survey was later extended to include 940 trees taken from the three principal cocoa producing districts. The results of the quantitative survey are tabulated and show the limits and modes of variability for each of the characters studied. For the qualitative survey the author has evolved a new classification of 110 classes for Trinidad cacao, necessary because under the name Trinidad Forastero or Trinitario this cacao is said to include types possessing every combination of characters possible to cacao and so well mixed that "a random composite sample of 1,000 trees is likely to present a close approximation to the distribution of type in the whole population". It did not appear that any particular shape or colour classes could be taken as indicative of good yielding trees. As frontispieces to the report for 1932 are three notable coloured plates illustrating and naming eleven pod colour classes, and a plate showing some pod shape classes.

397. POUND, F. J. 633.74-1.52
Note on the progeny of a single cacao tree.
Second Ann. Rept. on Cacao Research for 1932, I.C.T.A., Trinidad, 1933, pp. 25-6, bibl. 2.

The parent tree selected for examination, No. 4927 River Estate, has been recorded over a long period as a consistently high bearer. In spite of this feature its quantitative characters are too low to render it suitable for the distribution of seed. The pod characters of its nearest neighbours are here tabulated, since these may have had some influence on the progeny by crossing. The progeny examined number 80. Of these nearly half have the same, very dark red pod colour as the parent, and a large proportion are only slightly lighter in colour. The characteristic,

sharp point of the pod is shown by a quarter of the trees, the remainder having longer points, normal blunt points or no points at all. Fifty-six progeny are smooth skinned like the parent. Sixty-three have the medium furrows of the parent. The quantitative variability of the progeny is shown in a table of the extreme and modal values and the striking correspondence of the progeny mode with the parental mean is considered to be the outstanding feature of the investigation.

The cause of the low bean number of the parent and many of the progeny was considered to be mainly due to a low ovule number at the start and not to loss in subsequent development.

398. POUND, F. J. 633.74 : 581.162.3

Studies of fruitfulness in cacao. I. A note on the abscission of the flower.

II. Evidence for partial sterility.

First Ann. Report on Cacao Research for 1931, I.C.T.A., Trinidad, 1932, pp. 24-8, bibl. 2.

III. Factors affecting fruit setting.

Second Ann. Report on Cacao Research for 1932, 1933, pp. 29-36, bibl. 10.

The physiological factors governing abscission, the genetic factors of compatibility and the physical factors of pollination, on which depend the success or failure of a cacao flower to set fruit, are discussed.

I. Flowers produced during the dry season (May and June when fruit setting is low) seldom remain attached to the tree for more than one day, while unpollinated flowers produced in the wet season (September) will remain until the third day. The morphology of the flower pedicel is described and illustrated. Based on these observations and on other indirect evidence the theory is advanced that flower abscission is due to the accumulation of respirable material (which would have been removed if pollination had occurred) in the pedicel, causing sufficiently severe osmotic pressure at the point of constriction of the tissues coinciding with the base of the receptacle, to rupture the cells of the bundle and sever the flower. The failure of May and June flowers to set fruit may therefore be due to early abscission caused by high concentrations of osmotically active materials during this period, when new canopies are being added and little crop is being removed from the trees. The osmotic concentration of material in the stylar tissues may also not be favourable for the quick development of the pollen tubes, which are exacting in their conditions for optimum growth, and if fertilization is responsible for the inhibition of the abscission mechanism, quick growing pollen tubes would be more effective than slow.

II. The possible reasons for the wilting and subsequent loss of young cacao fruit, not due to weather conditions, are considered. Ovule counts of wilting and sound cherelles (young fruits 2-3 inches long) showed no significant difference. There are no grounds, therefore, for assuming wilting to be due to incomplete pollination. Eight (scion) clones were tested for self incompatibility and three gave very poor results in selfing judged by the number of pollinations surviving six days. On this period the superiority of foreign pollen is clearly shown. The proportion between final yield and fruit setting may be exemplified by the fact that out of 1,400 pollinations only 20 pods were surviving four months later, 15 having been cross-fertilized. It is noted that this demonstration of the existence of pollen incompatibility in cacao is of great importance, and calls both for further research and economic application. "There are indications of a correlation between the initial rate of growth of the pistil and the number of successful pollinations."

III. Observations on natural setting conducted on 10-year-old trees over nine months from January to October, 1931 and from May to December, 1932, if they can be held valid for other years, appeared to establish the following facts. When a flush is in progress, flowering is reduced and conversely reaches its peak, when vegetative growth is dormant. However, from the end of September in both years flushing and flowering occurred almost simultaneously. There appears to be no correlation between flowering and setting. The effect of flush upon setting is normally to reduce it, yet in September of both years the setting maxima coincided with the simultaneous maxima for flowering and setting. Experiments were made to test the effect of manipulations on setting. Ringing resulted in the production of three times as many flowers

on the ringed branches but did not increase the proportion of setting, or affect the time of setting or the proportion of cherelles wilting before they are seven weeks old. Manuring with nitrate of soda at the rate of 3 lbs. per tree appeared almost to double the setting, while the wilting of cherelles was reduced to nearly half that of the controls. More comprehensive experiments are being initiated to test these important results. Heavy pruning by removal of one-third to one-half of the leaf area also reduced wilting but at the same time reduced fruit setting also, from which it is assumed that in setting "the actual level of the carbohydrate or nitrogen supply is more important than the carbohydrate or nitrogen ratio" at least under the conditions of the experiment. Insect relations to setting were examined. Of five adjoining trees used in pollen compatibility trials only one (labelled No. 8) was found to be setting naturally and this tree was (1) the only self-compatible tree, (2) the only tree that was heavily infested with ants and aphides. Various workers have proved the association of these insects with natural setting, and the author found in a large plantation that the only trees setting fruit were those infested by sucking insects; furthermore bagged flowers of the same self-compatible No. 8 did not set unless insects were left in the bags or the flowers were hand pollinated. These results suggest to the author that "pollination is only part of the story and that in some way or other the sucking insects single out the self-compatible trees, or else they are themselves a cause of self-compatibility." Again, if turgor from the accumulation of osmotically active substances is a cause of abscission and setting is caused by its removal (see Section I), might not a number of aphides sucking at the base of the pedicel so reduce turgor as to delay abscission and aid setting? During May and June self-sterile trees compatible with No. 8 and growing alongside set no fruit by natural means though flowering freely, while self-compatible No. 8 set well. This points to an absence of effective agents for cross pollination during these months. Although self-fertile trees would seem to be the more efficient, self-sterile trees are by no means always barren, though the actual agent of cross pollination has, the author states, so far eluded all investigators. Under present conditions of cultivation the mechanism for the natural pollination of cacao is inefficient.

399. PYKE, E. E.

633.74-1.535

The vegetative propagation of cacao. II. Softwood cuttings.

Second Ann. Rept. on Cacao Research for 1932, I.C.T.A., Trinidad, 1933, pp. 3-9, bibl. 1.

In these experiments fan branches and chupons were used. [Chupon is the name for the suckers which frequently arise at the base of the trunks or occasionally on the branches of cacao trees. The same term is applied to the shoots produced by layered or stooled stems.—Ed.] The fan branch cuttings found to give the best results were those making an extension of 9-15 inches at each flush, which should be fully mature when used. Cuttings got from trees growing under light shade or none compared unfavourably in their rooting with those from vigorous trees under medium or fairly heavy shade. The most successful chupons were those from layered or stooled stems, since they exhibited fairly well defined flushes with intervening dormant periods. The terminal parts are usually too soft to use, being then liable to attacks of "chupon wilt" (*Phytophthora palmivora*) in the propagator. On the whole chupon cuttings give a moderately high percentage of rooting and establishment under less strictly controlled conditions during rooting and hardening than are necessary for fan cuttings. The new roots of chupon cuttings, it was noticed, emerge and descend vertically, whereas the roots of fan cuttings are produced and grow horizontally. This difference in habit is also reflected in the top growth, the first flushes of fan cuttings tending to deviate from the vertical, while those of the chupons are erect. The most successful propagating frame, usually giving 90% of rooting with good material, was a concrete cool frame 11 ft. x 6 ft. x 2 ft. 4 ins. high, divided into six equal sized glass-lidded chambers protected from sunlight by an overhead canopy and side shades. The optimum illumination appeared to be one-fourth to one-eighth relative to an open northern sky. An even temperature of 26°-29° C. (78°-84°-2° F.) was maintained. A practically saturated atmosphere was found to be necessary from the setting of the cutting until about two weeks after rooting and even then the reduction of humidity must be extremely gradual.

400. McDONALD, J. A. 633.74-1.4
Progress of some detailed investigations. I. The phosphate status of cacao soils. II. The nitrogen status of cacao soils. III. Chemical composition of the leaves of cacao in relation to environmental growth conditions, and with special reference to thrips attack.

Second Ann. Rept. on Cacao Research for 1932, I.C.T.A., Trinidad, 1933, pp. vi-viii, bibls. 2, 3 and 4.

I. Manurial experiments have been laid out on four different soil types showing phosphate deficiency to test the effect of different quantities of soluble phosphatic manure on yield of cacao. The results are not sufficiently advanced for discussion. Reference is made to the pot tests for phosphate deficiency already made, and described in *Trop. Agriculture*, 1933, 10 : 108, *H.A.*, 1933, 3 : 3 : 357.

II. Definite seasonal fluctuations in the nitrate content of the good and bad experimental plots have not been observed. Both soils are sufficiently able to form nitrate from soil organic matter, though their nitrate content is generally low. Air-drying greatly increased the amount of water-soluble components in the good plot soil, but had no significant effect on the bad plot. The formation of nitrates takes place chiefly in the top 6-inch layer of soil. There is in this layer a good degree of correlation between the electrical conductivity values and the nitrate content of the fresh soil samples in the good and bad plots but not of the stored soil samples, though high peat values for conductivity coincide with high peat values for nitrate content.

III. Chemical determinations made for the different leaf components of six average trees each on the good and bad plots revealed differences between the leaves from each plot and between young leaves and mature leaves. The significance or otherwise of these differences is shown in tables of statistical analysis. The nitrogen content is significantly lower and the phosphate content significantly higher in young than in mature leaves. The potash content is erratic. Nitrogen, phosphate and potash contents expressed as percentages of total dry matter or ash show highest values in the young leaves. The nitrogen/potash ratio is higher in the mature leaves than in the young and, as between the leaves of the good and bad plots, is higher in the young leaves of the bad plot, and exhibits no significant difference between the mature leaves from each plot. Cacao trees attacked by thrips show a high nitrogen/potash ratio in the young leaves.

401. McDONALD, J. A. 633.74-1.4
A survey of some Trinidad cacao soils.
Second Ann. Rept. on Cacao Research for 1932, I.C.T.A., Trinidad, 1933, pp. iv-v, bibl. 3.

Recent work on the soils of Trinidad, Tobago and Grenada shows that a high available phosphate content and a high C/N ratio appear to distinguish good cacao soils from bad, while the significant effect of other factors of acidity, alkalinity, available potash, total nitrogen and total organic matter was not demonstrable. Further work on a group of good cacao soils could point to no one factor definitely related to differences of yield. On all soil types investigated the fitness of the soil to produce good cacao was closely bound up with the water relationship. The ideal is a free drainage in wet weather combined with retention of moisture during dry. An example of this is known as the Chocolate Soil type and consists of a clay loam containing 40% of sand (clay M.P.S. 50%) underlain by a porous, calcareous, brown sandstone.

402. McDONALD, J. A. 633.74 : 581.02
An environmental study of the cacao tree.
Second Ann. Rept. on Cacao Research for 1932, I.C.T.A., Trinidad, 1933, pp. ii-iv, bibl. 6.

The observations were made on two cacao plots, representative of a good and bad cacao environment respectively. The meteorological and environmental data are graphically presented. Discussing the relation of weather to general growth conditions it appears that :—(a) growth

flush accompanied by leaf change coincides with a fall in atmospheric humidity ; (b) growth flush without leaf change coincides with a rise in soil moisture ; (c) flowering and fruit setting occur during a period of uniformly high moisture conditions ; (d) blackening of pods occurs during periods of excessively high moisture conditions. An examination of the effect of weather on yield showed that the principal flowering and fruiting occurs during two periods of high moisture conditions each lasting about three months and that, if a short spell of dry weather should intervene, a premature vegetative growth will start which materially checks the process of fruiting. Thrips attack (*Heliothrips rubrocineta*), which has considerable influence on the yield, is definitely associated with a fall in soil moisture combined with a high atmospheric humidity. Relationship of rainfall with yield is difficult to correlate, since it is the effect and not the magnitude of rainfall that must be considered. A tentative method is adopted here and the question is shortly to be studied in detail. From a comparative study of the graphical record of the good and bad plot it is shown that the environment of the good plot is subject to less extremes of fluctuation in soil moisture and atmospheric humidity. It is suggested from data obtained in this study that the probable benefits of shade trees in a cacao plantation arise from the stability they induce in the environment.

The following also is noted :—

PYKE, E. E. **The physiology of cacao. I. General observations of growth, flowering and fruiting.** *Second Ann. Rept. on Cacao Research for 1932*, I.C.T.A., Trinidad, 1933, pp. 37-40.

403. JOACHIM, A. W. R., AND PIERIS, H. A. 633.825-1.8
A ginger manurial experiment.
Trop. Agriculturist, 1933, 80 : 262-7.

The manurial experiments were undertaken to determine whether the yields of ginger could be improved. The experimental plot was situated at Siyambalagoda near Peradeniya, and was one-thirtieth acre in extent, of ferruginous, gravelly loam lacking in organic matter and slightly acid in reaction. The lay-out and treatment are described. The results were statistically examined and the following conclusions drawn. Sulphate of potash gave 40% increase, and a complete fertilizer gave 80% increase, the odds being 20 to 1 and 100 to 1 respectively against those differences being due to chance. Nitrate of soda and superphosphate gave no significant results.

404. CRAMER, P. J. S. 633.912-1.541.5
 Le greffage de l'Hévea en Indochine. (**Budding of Hevea in Indo-China.**)
Rev. Bot. Appl., 1933, 13 : 97-104.

It was not until 1930 that the budding of Hevea took place on a large scale in Indo-China. Interest was fully aroused by 1929, but, as in other countries, the work was held up by lack of budwood from proved clones and by lack of men able to bud. The latter disability was soon overcome, the coolies under instruction readily acquiring the technique. To overcome the lack of budwood importations of the cut wood were made mainly from Java and Sumatra but later from Malaya. This method proving unsatisfactory, budded stumps were introduced and by the end of 1929 could be counted in tens of thousands. The percentage of successes with these was generally above 50% and sometimes over 90%. A year later each imported stump could provide 2 metres of budwood or material for 20-40 buddings. By the end of 1932, 30,000 hectares were under newly budded rubber, almost every clonal type of importance being represented. Budding was mainly done on stocks already *in situ*, because the rainy season is too short always to allow of both budding and transplanting before dry weather sets in, and also because there happened to be available large areas of newly planted seedling rubber a year or two old which could thus be transformed into clonal plantations without delay. Various methods of arranging the lay-out are discussed. Certain experts advise a systematic interplanting of 5 or 6 clones so that, should any prove unsuitable, they may be eliminated without undue decrease in the density of the stand. The author, however, deprecates this theory and urges

the planting of monoclonal blocks of a number of varieties. The cultural needs which are by no means the same for each clone can thus be supplied with the maximum economy and efficiency. No further large-scale budding operations will be carried out after this year owing to market conditions. The question what to do with the old plantations of seed-grown rubber, agitating other countries besides Indo-China, is discussed. Fortunately root disease (*Fomes*) is absent, so that the expensive precautions attendant on replanting in Sumatra and Malaya are not necessary.

405. TENGWALL, T. A. 633.912-1.543.83
Uitdunning in Hevea-tuinen. (**Thinning out in Hevea plantations.**) [English summary, 17 pp.]

Archief v. d. Rubbercultuur in Ned. Ind., 1933, 17 : 41-82, bibl. 19.

This is a long and careful analysis of the case for and against thinning of trees in rubber plantations. It is shown that the premises on which certain previous writers based their opinions were false. As a result of a series of experiments which are described the author states that in his opinion thinning out in older plantations, where the trees have already assumed the limits of lateral development imposed upon them by the available space, does not increase yield in the next few years and probably never will sufficiently to make up for the loss caused by thinning. In young plantations, however, where the trees are not yet in competition with each other, thinning out, by permitting the remaining trees to develop normally, does strongly increase the growth of girth and therefore the yield.

406. BRINKGREVE, J. H. 633.832
De kruidnagelcultuur in de residentie Sumatra's Westkust. (**Clove cultivation on the West Coast of Sumatra.**) [English summary, 1 p.]
Landbouw, 1933, 10 : 646-60.

The cultivation is a mixed one, usually in combination with coconuts and coffee. The methods of cultivation are primitive but the crop is of considerable importance to the district in which it grows. Suggestions for improvements in cultivation are made.

407. MOHAMMAD, A., AND OTHERS. 634.58
Studies on germination and growth in ground nut (*Arachis hypogaea* Linn).
Agriculture and Livestock in India, 1933, 3 : 91-115, bibl. 10.

Various germination tests were made and described, from which it is concluded that :—(1) seeds soaked in water for 12 hours before sowing appeared above ground 2 days earlier than unsoaked seeds and gave 100% germination as against 45% ; (2) partial or total removal of cotyledons did not seriously impair germination, but the plants made poor growth subsequently ; (3) removal of seed coat before sowing resulted in almost total loss from fungus attack ; (4) soaked pods gave 20% better germination than unsoaked pods and appeared 4 days earlier, but unsoaked seeds proved 5-12% more efficient than soaked pods. The time elapsing between shelling and sowing, tested up to 15 days, has no effect upon germination. A detailed study of the root and shoot growth under irrigated conditions was made of 3 varieties, the erect Small Japan and Small Spanish and the prostrate Burmese. Earliness is associated with erectness of habit. The roots of growing plants were exposed for examination *in situ* by washing away the soil with a sprayer. The spreading variety Burmese showed the more vigorous root and shoot growth, while Small Spanish had the smallest spread of lateral roots. In all three varieties root nodules developed to the extremity of the main root, some 130-190 cm. long, but were much more numerous in Burmese. After 110 days' rapid growth the erect varieties suddenly declined in vigour, the prostrate variety continued, however, to grow vigorously even when 140 days old. The need for a liberal water supply during the period of maximum vegetative growth, lasting from the 56th to the 97th days after sowing in the erect types and from the 70th to the 125th day in the prostrate, is stressed. Plants grown in sand had pale green foliage and very few root

nodules, in clay dark green foliage and no root nodules, and in both cases poor development of shoot and root. The addition of lime resulted in greatly increased root and shoot development, nodule formation and in earlier flowering. Ammonium sulphate had the reverse effect in each particular. The presence of root hairs, hitherto doubted by previous investigators, is demonstrated. Owing to their extreme delicacy they are ordinarily impossible to trace in the field. The function of the hairs on the gynophores is discussed, and the suggestion is advanced that their only use can be, by the absorption of moisture, to prevent the pod from excessive drying.

408. BELGRAVE, W. N. C., AND LAMBOURNE, J.
Manurial experiments on coconuts and oil palms.
Malayan Agr. J., 1933, 21 : 206-14.

631.8 : 634.6/61

The layout of the experiment on coconuts consisted of 4 experimental blocks of 64 palms divided each into 4 plots of 16 palms on each of 7 coconut estates. Each of the 4 plots of 16 palms is again subdivided into 4 tree plots to which are applied (a) complete NPK ; (b) lime ; (c) lime and NPK ; (d) nothing. The plots are safeguarded by drains and guard rows. Results from statistical analysis for 1932 show that after 2 years no manurial increase is significant, but that clean weeding shows a definitely better result over other cultivation treatments (cover crop, grass, or slashing of cover) on Estate B, is better than slashing on Estate D and just misses significance on Estate F. The chief feature of the experiment has been the improvement of yield due to cultivation on Estate B.

The experiments on oil palms on two estates and at the Government Experiment Station, Serdang, show, when statistically analysed, that gains resulted from manuring with phosphate manures on Estates A and B, while no further increases resulted from the addition of potash, nitrogen or magnesia. It is recommended that manuring should be carried out on organic or on quartzite hill soil or on areas yielding less than 1,300 lbs. of oil per acre at 10-12 years ; on other soils and in higher yielding areas preliminary experiments should be made before incurring the expense of manures.

409. SMITH, A. C.
Practical seed selection of coconuts.
Malayan Agr. J., 1933, 21 : 265-71.

634.61-1.521

Seed selection in coconuts has always to contend with cross pollination and consequent hybridization, since under normal conditions the coconut seldom selfs, and there is at present no adequate available supply of seed coconuts of pure strain. Suggestions for efficient seed selection under existing estate conditions are made. The chosen area should contain a large number of palms yielding well above the average, when the chances of cross fertilization with a high yielding parent will be probable, and a close examination should be made of individual palms which will at least ensure a good female stock. Only palms bearing 100 nuts or more should be selected as possible parents. All ripe nuts from these palms are collected and one typical specimen from each is examined for wet weight of wet meat. On a selected high yielding area of 80 acres carrying 3,875 palms 17.8% bore 100 nuts and over. Thus the average of high grade palms in even a very high yielding area is very small and mass seed collection from such area is unsound. Of the 3,875 palms examined only 6% gave 100 nuts of 500 grammes or more of wet meat, and 500 grammes is the lowest advisable standard for seed selection. The shape or colour of the nut appeared, contrary to general belief, to have no influence on the meat content. Germination trials in November and February showed that average sized nuts gave slightly better germination and stronger plants than large nuts. The germination in both trials was 60% of good plants after 4½ months. Thus 80-90% of seed in excess of requirements should be laid down. The author considers that by these methods of selection the potential yield should be in the region of 20 piculs of copra per acre, whereas at present even 15 piculs of copra per acre is deemed extraordinary.

410. TACHDJIAN, E. 634.651
 Etat actuel de nos connaissances sur le papayer. (**Present state of our knowledge on the papaw.**)
Rev. Bot. Appl., 1933, 13 : 196-201, bibl. 7.

Fourteen sexually different forms of *Carica Papaya* are described. This variability, since the plant is only grown from seed, is an impediment in its commercial cultivation, since plantations have been known to contain 75-85% of males, whose presence cannot be detected till the plantation is about to flower. The present aim of the plant breeder is to fix a hermaphrodite strain. The best varieties in Brazil, the Philippines and California are described. Early senescence is an obstacle to vegetative propagation, 3 to 4 years being the longest that a tree will remain profitable. Fairchild's grafting method as used in Florida is described. Seeds sown under glass in February are ready for grafting when 20-30 cm. high in March. At this early age the stem has no central cavity. The scions are produced by decapitating a tree in full bearing and allowing subsidiary branches to develop to the number of about 50. When they are 10 cm. long and of pencil thickness they are cleft grafted on to the seedling stock. It is unnecessary for the scion to be as thick as the stock, but it must not be thicker. Grafted plants will fruit 8 months later. The fruit is improved if water is withheld during ripening.

411. WARDLAW, C. W., AND MCGUIRE, L. P. 634.771/2
Cultivation and diseases of the banana in Brazil. I. Cultivation.
Trop. Agriculture, 1933, 10 : 192-7, bibl. 4.

Topography and climate of the banana lands in the State of Sao Paulo are described. The chief varieties of banana exported are Cavendish and Mastica, this last appearing to be the Grenada Giant Fig. The soil types are :—(1) a humus-laden, alluvial, fine silt or clay known as tabatinga, lying only sufficiently above high tide to admit of drainage ; (2) an alluvial light to medium loam derived from the sierra granite and well drained, extending inland from the tabatinga marginal soils to the base of the sierra ; (3) less fertile hillside soils. Details are given of local cultural methods and allusion is made to the apparently successful experiments in the renovation of worn-out banana soils (i.e. after 15 years' continuous banana growing), by intensive cultivation in which the ground is tractor ploughed, disc harrowed and ridged, the new plantings, "bits with two eyes", being made on the ridges. An average good yield is about 600-700 bunches per acre of 7 hands and upwards in the third year. The government standard for export, however, is now not less than 8 hands. The authors investigated the method of fruit cut and consider that no alterations are needed in the methods, which are up-to-date, but that a more careful supervision is needed. Stowage of bunches on board ship needs improvement. The bunches should be graded for size, and tight vertical stowage except in the topmost layer is essential. Pressure on non-vertically or loosely stowed bunches causes splitting of the main stem with consequent exposure of the wounds to a fungal attack, which thence will soon invade the finger stems and fruit. Objections of the Trade to tight stowage on the ground of bruising and asphyxiated or dull fruit are shown to be invalid, the damage being due rather to loose packing, the purchase of fruit from smallholders in the "blow-down" season, and delay between harvesting and refrigeration. [The remainder of the paper will be abstracted as it appears.—ED.]

412. WARDLAW, C. W. 632.48 : 634.771
Panama disease.
Trop. Agriculture, 1933, 10 : 151-4.

This article is a review and discussion of a recent memoir on a new wilt disease of bananas which is spreading in the Canaries (Del Canizo, J., and Sardina, J. R. *La enfermedad de la plantera en el valle de la Orotava, Boletín de Patología Vegetal y Entomología Agrícola*, Madrid 6, 1933). Two strains of *Fusarium* have been isolated from infected trunks and have been identified by Wollenweber as morphological forms of *F. cubense* E. F. Sm., which is the recognized cause of the disease on susceptible varieties in the West Indies, of which the Cavendish or Canary variety (called "Governor" in Trinidad) is not one. The possible reasons for the

lessening of resistance to the disease in the Canaries are discussed. Remedial measures are suggested and differ from the more drastic ones of the West Indies in allowing replanting on affected land after a few months, in only trimming out the diseased parent plant and leaving the apparently uninfected daughter suckers, and in the non-isolation of affected areas.

STORAGE.

413. TILLER, L. W. 664.85.11.037 : 656.61
Relation of storage temperature to the overseas carriage of some further varieties of New Zealand export apples.
New Zealand J. Sci. and Technology, 1933, 14 : 241-51, 288-97, being *Cawthron Inst. Cold Storage Publ. 10*.

This paper gives the main observations on the behaviour of seven commercial varieties of New Zealand apple under closely controlled storage conditions in 1930 and 1931. The varieties dealt with are Cox's Orange, Jonathan, Cleopatra, Rome Beauty, Granny Smith, Dougherty, Worcester Pearmain. These are treated separately and the causes of wastage in each are discussed, recommendations being made when possible for its control. A previous paper by the same author (*N. Z. Dept. of Sci. and Ind. Res. bull. 23* and *Cawthron Inst. Cold Storage Publ. 6*, 1930) deals similarly with observations made in 1929 on Cox's Orange, Dunn's Favourite, Jonathan, Delicious, Statesman, Sturmer. Varieties occurring in both papers are those in which the information obtained in 1929 was deemed to require expansion.

414. KIDD, F., AND WEST, C. 664.85.11.035.1
Gas storage of fruit. III. Lane's Prince Albert apples.
J. Pom. Hort. Sci., 1933, 11 : 149-70, bibl. 9.

In previous investigations (*J. Pom. Hort. Sci.*, 1930, 8 : 67, noted in *H.A.*, 1931, 1 : 1 : 100) it was found that for Bramley's Seedling apple the most efficient combination of the conditions then tested was a temperature of 5° C. (41° F.) with an atmosphere containing about 10% CO₂ and the equivalent subnormal percentage of oxygen. In the experiments now reported the optimum conditions for storage of Lane's Prince Albert appeared to be a temperature of 4° C. (39° F.) and an atmosphere containing 2.5% oxygen and 5% CO₂. Under these conditions the commercial storage life of the fruit was twice as long as that in air at the same temperature and nearly double that in air at 34° F. which is ordinary cold storage temperature. The paper is excellently illustrated with diagrams, graphs and tables, and the authors give considerable detail of their methods and apparatus. Thus when speaking of grading fruit prior to storage they note that details were taken of pre-storage history, e.g. date of picking, stock, soil, age of tree, each sample receiving an equal number of fruits from each grade and size. They also describe the constant temperature rooms and the construction of the storage cabinets. Further they note the criteria used to determine the condition of fruit at each examination.

415. MARKLEY, K. S., AND SANDO, C. E. 634.11 : 581.192
Progressive changes in the cuticle of apples during growth and storage.
J. Agr. Res., 1933, 46 : 403-12, bibl. 13.

The tests were made on the shady side of the apples. Discs were removed by means of a standardized cork borer and immersed for 24 hours in dilute HCl. The cuticle was separated from most of the flesh by tweezers, washed with distilled water and dried over sulphuric acid. The product was then analysed. The following notes are from the authors' summary. In confirmation of previous results it was found that quantities of ursolic acid, oily fraction, and total ether extract present at maturity and at the end of the storage period were greater than those found in early stages of growth and that they increased from the time of picking to the end of the storage period. Moreover with increasing maturity there was in general a progressive increase in the percentage of the oily fraction in the total ether extract.

416. POTTER, MYRA T., AND OVERHOLSER, E. L. 634.11 : 577.16

The vitamin content of the Winesap apple as influenced by fertilizers.

J. Agr. Res., 1933, **46** : 367-73, bibl. 10.

The trees used were 20 years old and were growing in a gravelly, coarse sandy loam, the orchard being under a poor weedy stand of lucerne and undergoing irrigation by the rill or furrow system. The trees either received no fertilizer or 5·7 lbs. each of an equal mixture of ammonium sulphate and sodium nitrate, 11·7 lbs. superphosphate and 3·9 lbs. equal parts of KCl and K₂SO₄. The fact that 60% of the guinea pigs receiving 5 g. of apple from manured trees were protected and developed only mild scurvy, while not one of the animals fed the same amount from the non-manured trees was protected and 80% developed scurvy, is significant. This indicates only that completely manured trees are a better source of vitamin C than unmanured trees, it being necessary to feed more apple from unmanured trees to attain the same amount of antiscorbutic protection than from the manured trees.

417. FELLERS, C. R. 634.11 : 577.16

Vitamin C content of Baldwin apples and apple products.

J. Agr. Res., 1933, **46** : 1039-45, bibl. 11.

Tests were made on guinea pigs. The fact whether a tree was sprayed or not was not found to affect the vitamin content. Baldwins were found to retain most of their vitamin content for several months in store. After 9 months the loss was found to be about 33%. There was a marked loss in vitamin C when Baldwin apples were manufactured into benzoated or pasteurized cider. Canned Baldwin apple sauce either strained or unstrained proved a bad source of vitamin C.

418. JOSLYN, M. A., AND MARSH, G. L. 664.85.037 + 664.84.037

Changes occurring during freezing, storage and thawing of fruits and vegetables.

Univ. Calif. Agr. Exp. Sta. bull. **551**, 1933, pp. 40, bibl. 14.

The writers discuss not only the changes that occur, but also the chemical processes involved. They find that the chief factors determining the rate of temperature change were the specific heat and heat conductivity of the product, the temperature at which the ice began to separate, the amount of ice that separated under freezing conditions, the size and shape of the container, the initial temperature and the temperature of the refrigerant. The effect of neighbouring containers in the case was more marked than that of types of cases. They discuss the factors causing loss of weight of fruit on thawing and the effect of blanching vegetables on weight on thawing. They note that the increased concentration of soluble solids in fruits frozen with sugar or syrup was due to penetration of sugar into the fruit as well as to withdrawal of water by the osmotic action of the added sugar. It was found impossible to inactivate the active oxidases which cause discoloration and bad flavour of fruit exposed to air during freezing or during or after thawing, or satisfactorily to inhibit oxidase formation. In vegetables, however, oxidative changes resulting in poor flavour could be inhibited by blanching in steam or boiling water. Other changes due to various causes including anaerobic respiration are noted.

419. CALDWELL, J. S., AND OTHERS. 664.85.25.037 + 664.85.75.037

Varietal behaviour of strawberries and peaches preserved by frozen pack methods.

Proc. Amer. Soc. Hort. Sci., 1932, **29** : 282-6.

The effect of type of container and rate of freezing were also noted. Preservation of colour was distinctly better in hermetically sealed than in paper containers. Rapid freezing showed a disadvantage as compared with slow freezing in peaches, in that on thawing the rapidly frozen peaches underwent a more rapid and extensive oxidization which injuriously affected colour, odour and flavour. No differences were detected in the case of strawberries. As regards

varietal differences factors considered were colour, odour, texture and flavour of fruit, colour and appearance of liquid and rate of change in these characters on thawing and standing in air. Out of some 64 strawberry varieties Big Joe and Redheart were found to be outstandingly good, Klondike, Brandywine and Blakemore also being in the front rank. The others were ranked as second and third.

Of the 18 peach varieties, J. H. Hale, Reeves, Chairs, St. John and Up-to-date were distinctly superior to other varieties in practically all points considered in the grading.

PROCESSING, FRUIT PRODUCTS.

420. CHARLEY, V. L. S. 663.3
Investigations on fruit products. I. Preparation of juices, syrups, concentrates and wines from some English fruits.

Long Ashton Res. Sta. Ann. Rept. for 1932, 1933, pp. 175-201, bibl. 10.

The preparation of fruit syrups, concentrates and wines offers an outlet for surplus fruits. A wide scheme of research on the utilization of such fruit was initiated in 1932 at Long Ashton. In this paper details of the methods and quantities of materials used in the preparation of syrups, concentrates and wines are detailed, remarks being confined in the case of syrups to their manufacture and present condition. The remarks on the quality of the wines are based on observations made in March, 1933, when, it will be realized, the wines were still immature. The preparation of juice is described for the following fruits:—green gooseberries, rhubarb, strawberries, red currants, raspberries, black currants, loganberries, blackberries and plums. The method of getting syrups from most of these is described, as also the preparation of concentrates in the case of strawberries, red currants, loganberries and blackberries. Details are given of the making of wine from all the above except plums together with notes on the character of the wines at the present time. The sweet wines are at present much superior to the dry products, but a final judgment on any particular character cannot yet be given.

421. CHARLEY, V. L. S. 663.325
Investigations on fruit products. II. Enzymic clarification of fruit juices.

Long Ashton Res. Sta. Ann. Rept. for 1932, 1933, pp. 202-13, bibl. 10.

The writer gives a short account of previous work in this field. He discusses the nature of the colloidal constituents in fruit juices and discusses methods for their removal. He describes "pectinol", an enzyme which decomposes pectin material, and details the results of attempts to clarify various juices on a small scale with this preparation. After stressing the fact that these results are not necessarily, without further trial, applicable on a commercial scale, he concludes as follows:—"Excellent results were obtained on strawberry juice, but with juices of higher acidity, such as loganberry, raspberry and black currant, considerable fermentation occurred before any very noticeable results of the enzyme were apparent. Some degree of clarification was effected with all juices. The pectinol percentages were varied in each experiment, the figure which gave the best results being 1%. Evidence is adduced that enzyme action sometimes continues after filtration of juices through a Seitz sterilizing filter, causing further deposits to form."

422. CHARLEY, V. L. S. 663.813
Investigations on fruit products. III. Non-alcoholic apple juice.

Long Ashton Res. Sta. Ann. Rept. for 1932, 1933, pp. 214-31, bibl. 9.

The cider industry cannot absorb unlimited amounts of culinary fruit, and in this paper, which is of an introductory nature, various aspects of the problem are discussed. Foreign methods and those used experimentally at Long Ashton are described. The writer summarizes as follows:—
 " . . . 2. Experiments are described which illustrate the effect on flavour, colour, and chemical

constituents of clarifying and sterilizing processes. Filtration through a germ-proof filter is shown to affect adversely the 'body' and colour of the juice. A pectin-decomposing enzyme [pectinol—ED.] is described and its action on the juice and the resulting increase in clarity and loss of 'body' are discussed. The changes in pectin in the juices are given in terms of calcium pectate, and the correlation between lack of flavour and loss of pectin is indicated. The general nature of the juices prepared from 'cull' sorts of culinary apples is discussed and the products shown to possess attractive characters. 3. Preliminary experiments with the centrifuge as a means of clarifying cider are discussed."

423. CHARLEY, V. L. S. 663.3

Volatile acidity in cider. A. The estimation and identification of volatile acids in cider. B. The development of volatile acidity in bottle and cask ciders.

Long Ashton Res. Sta. Ann. Rept. for 1932, 1933, pp. 156-74, bibl. 5.

1. Various methods for the analysis of volatile acidity in cider are described and their results compared. The English method is shown to be the most accurate of those considered. 2. The development of volatile acidity in cider bottled under various conditions is discussed. The experiments show that for long periods of storage at moderate or high temperatures, screw stopper and crown cork bottles are unsuitable, whilst the champagne type of bottle is very satisfactory. The effect of high temperatures is to increase the rate of development of volatile acidity very considerably. Where possible, bottles should all be stored in a horizontal position. Development of acetic acid is somewhat retarded in ciders with a higher percentage of alcohol. 3. The increase of volatile acidity in cask ciders is discussed, and data are presented to show the importance of keeping the casks as air-tight as possible. Various methods of achieving this are demonstrated by experiments concerning the effect of ullage and cask linings, both of which are shown to affect the cider to a marked degree. 4. The volatile acids present in a Kingston Black cider have been identified as mainly acetic acid with smaller quantities of caprylic, caproic and formic acids. No evidence of the presence of valeric acid was found. [Author's summary.]

424. KNOTT, J. C., AND OTHERS. 634.11-1.57

The feeding value of dried apple pomace for dairy cows.

Washington Agr. Exp. Sta. bull. 270, 1932, pp. 19, bibl. 11.

The experiments indicate that dried apple pomace offers a palatable feed of only slightly less value than dried beet pulp. It is noted that it is low in protein and needs supplementing in this respect.

NOTES ON BOOKS AND REPORTS.

425. QUINN, G. 634.1/8-1.542

Fruit tree and grape vine pruning.

Robertson & Mullens Ltd., Melbourne, Australia, 1932, 7th ed., pp. 278, price 5s.

Although this book is primarily written for those engaged in the cultivation of fruit under South Australian conditions, its value to growers in cooler climates is in no way diminished, if due allowance is made for their decreased sunlight.

The first few chapters deal with the basic principles of pruning, and thereafter in succeeding chapters each fruit is taken in turn and all methods applicable to it are carefully described. The descriptions are reinforced with ample illustrations which indeed form one of the most valuable features of the book, those of the "before and after" type especially being of great practical utility. The fact that this book is now in its seventh edition is a sufficient testimony to its worth.

426. KRJUKOV, F. A.

634.22

The plum.

Lenin Acad. Agric. Sci., Inst. Pl. Ind. & New Cult., Leningrad, 1931, pp. 347.

A brief botanical description of the genus is given, with illustrations. Over 250 species are known widely distributed over the northern hemisphere and the centre of origin is yet to be determined definitely. The greatest number of representatives, however, certainly occurs in Asia. There follows a key to the species of the plum group (*Eupruneus* Koehne) of the sub-genus *Prunophora* Focke, and of the group *Prunocerasus* of the same sub-genus. The most frequent in the Swiss lake dwellings was *Prunus spinosa* L. Others, including *P. insititia* and *P. domestica*, have also been found, however, showing the early introduction of the latter into Europe; the specimens of the fruit suggest that they were used for food and probably dried. From about A.D. 1300 onwards plums were more and more cultivated, the seventeenth century being a period of very vigorous development. The *insititia* plums were of earlier introduction, starting from the sixth century B.C. This was nearly the only species grown in North America before the revolution, largely on account of its seminal constancy. The *insititia* plums were also cultivated by the Greeks and Romans, but not *P. domestica*. Pliny mentions the latter as being of recent introduction. In all probability the Caucasus and the Caspian region is the zone of this origin, probably having been cultivated by the Huns, Turks and Tartars in pre-Grecian times. It is uncertain whether the plums of the oases of Central Asia are wild or introduced. The high quality of those described by Pliny and the absence of plums in the oldest writers on agriculture, indicated their adventive character and that those now growing wild in southern Europe are not truly indigenous. Details of plum cultivation in the Soviet Union and other countries are given, followed by a section of considerable length on vegetative reproduction, with remarks on the stocks suitable for different sorts,* on production of seedlings and on the methods of cultivation in general. Various early systems of classification are discussed, terminating with Hedrick's system which is taken as a type for the classification of the sorts of any particular area. Descriptions are then given of the sorts grown in the Soviet Union, together with certain Japanese sorts of interest for the southern part of the Union and two native American species. The descriptions are accompanied by illustrations and indications of the origin of the respective varieties and their fertility. There follow rather extensive sections on the utilization of the fruit and on its pests and diseases. [From abstract and notes received from the Imperial Bureau of Plant Genetics, Cambridge.]

427. WYE.

63(072)(05)

Journal of the South-Eastern Agricultural College, Wye, Kent,

No. 31, 1933, pp. 74, price 2s. 6d., post free.

This issue is in the nature of a general report. Work is in progress in the Entomological Department on the strawberry blossom weevil, the ovicidal effect of oil emulsions given as winter washes, new insecticides and possible insecticide-fungicide combinations, pyrethrum, pests of mushrooms, capsids. The Chemical Department is working on the analysis of spray materials, the ovicidal properties of oil sprays, the action of new fungicides proposed for the control of powdery mildews, the chemistry of bordeaux mixture, the incorporation of contact insecticides with copper-containing sprays, laboratory investigations of protective fungicides, spreaders. Mycological research embraces the downy mildew of the hop, apple scab spraying, pear scab, the mosaic and chlorotic virus diseases of the hop, immunity to mould in the hop, hop fungicides. Notes are given with regard to work on hops in general and on the hop research scheme. The botanical characters of *Pyrethrum* are being investigated by the Botanical Department. This department is continuing to observe morphological characteristics of apple varieties and further to make preliminary observations on the inflorescences of pear varieties and on the varietal

* These remarks consist of descriptions of the rootstocks used in England and America, there having been no original work done on the subject in the Soviet Union. The opinion of Skvortsov is quoted to the effect that the local plum of North Manchuria is a suitable rootstock for *Prunus salicina* Lindl. = *P. triflora* Roxb.

characteristics of cherries at flowering time. Observations have also been made on the growth of wood shoots of apple trees at ten day intervals, both rootstocks on their own roots and trees grafted with two scion varieties being used.

428. WYE. 63(072)(05)
Journal of the South-Eastern Agricultural College, Wye, Kent,
 No. 32, 1933, pp. 274, price 7s. post free.

The chief articles of horticultural interest are :—The inflorescences of apple trees II*—Horticultural accounts*—Investigations on the insect and allied pests of cultivated mushrooms*—Studies on the ovicidal action of winter washes, 1932 trials*—The control of apple scab ; Allington Pippin and Newton Wonder, 1932*—The downy mildew of the hop—A note on *Lygus pabulinus*.*

Soil studies embrace soils of North-West Cheshire (Wirral)—Hydrogen-ion concentration of the Wye farm—The field examination of the natural drainage of soils—A defence of the *soil-series* and American methods of soil classification.

429. BRISTOL UNIVERSITY DEPT. AGR. AND HORT. 634/635
A survey of recent work of the department in relation to its bearing on agricultural and horticultural practice.
 University of Bristol, March 1933, pp. 51.

The work is conducted at three centres, viz.—the Long Ashton Research Station, the Berkeley Square Advisory Centre, Bristol, and the Campden Research Station. Activities at Long Ashton are dealt with by Barker (pp. 5-15) and Wallace (pp. 16-24). Among them may be noted investigations on nutrition of fruit trees and bushes, seedling rootstock investigations and stock-scion relations, fruit breeding, cultivation experiments, ringing, the control of pests and diseases, fruit products including cider, willow cultivation especially for basket making. Wallace shows what has been done for the fruit grower to guide him in his manurial practice and gives brief notes on the following :—manurial problems, leaf scorch, fruit soil surveys, fruit quality and storage as affected by nutrition. Long Ashton also forms an advisory centre for information on market garden crops (pp. 40-43), summaries of work on diseases of these crops having appeared in recent annual reports. They are noted here. Hirst reviews briefly the activities of the Chipping Campden Canning Research Station (pp. 44-49). The quick growth of the canning industry in this country is noted. As regards future development possibilities seem to be offered by large-scale asparagus production for canning, while investigation is in progress on the best method of canning beets, beans, carrots, spinach, new potatoes and sprouts, and schemes for exporting English canned fruits to the tropics are being examined.

430. TRINIDAD, IMPERIAL COLLEGE OF TROPICAL AGRICULTURE. 633.74
Second Annual Report on Cacao Research for 1932, 1933, pp. 40 + xii.

The lines of research covered in the report are the vegetative propagation of cacao—particularly by soft wood cuttings, a genetic survey which presents frequency curves for all characters studied in 1,200 trees, a comparison between both the pod dimensions and the number of beans per pod for the same 300 trees in the fortunately very dissimilar seasons of 1931 and 1932 and a study of the seedling progeny of a single tree. Studies of fruitfulness are continued particularly as to factors affecting setting, and general observations are made on the growth, flowering and fruiting of cacao. The chemical and ecological section provides an environmental study of the cacao tree, a survey of some Trinidad cacao soils, and reports the progress of some detailed investigations on the phosphate and nitrogen status of cacao soils, chemical composition of leaves in relation to environmental growth conditions and thrips attack. Full abstracts of the papers comprising this report will be found elsewhere in this issue of *H.A.*

* Separate abstracts are given of these.

431. SOCIÉTÉ NATIONALE D'HORTICULTURE DE FRANCE. 634/5(063)
Report and Proceedings of the Tenth International Horticultural Congress, 1932. 1933, Soc. Nat. d'Hort. France, 84 rue de Grenelle, Paris (7e), pp. 287.

The report is in French, the papers in the language in which they were presented. Papers* given in full are:—

- FILEWICZ, W. General cultivation problems in fruit growing (F.).
 FILEWICZ, W. Reciprocal influence of stock and scion (F.).
 WROBLEWSKI, A. Acclimatization of trees and exotic shrubs (F.).
 PYNAERT, C. Investigations aimed at the elimination of harmful organisms contained in the soil round plant roots (F.).
 SCHEERLINCK, H., and CHARLIERS, N. Soil disinfection and plant disease control (F.).
 KLOTZ, L. J. A résumé of some aspects of disease resistance in plants.
 DUFRENOY, J. Virus diseases (F.).
 DUFRENOY, J. Biochemical factors of local immunity in plants (F.).
 PORTER, D. R. Disease resistance among truck crop plants.
 CAYEUX, L. Note on bacterial and cryptogamic diseases found on the dahlia in France and their control (F.).
 BARBIERI, N. A. Insecticidal action of tabacol (F.).
 BEATTIE, J. H. The significance of plot size and shape in relation to field trials with carrots and onions.
 PROEBSTING, E. L. Changes in concentration of certain constituents of the soil solution under orchard conditions.
 PALMER, R. C., and STRACHAN, G. C. Bud variation in the apple.
 SANDER, O. Breeding questions in connection with *Primula malacoides* (G.).
 SIMONET, M. Polyploidy in conjunction with gigantism in horticultural plants (F.).
 HONING, J. A. The rôle of bud mutations in horticulture (F.).
 WOYCICKI, St. Attempts to solve the problem of vegetative hybrids in lilac (F.).
 SCHOENER, G. M. A. The hybridization of roses in America.
 ALLAN, H. H. The horticultural significance of wild hybrids in the New Zealand Flora.
 HALL, Sir A. D. The genus *Tulipa*. (A note.)
 HALL, Sir A. D. The origin of the garden tulip. (A note.)
 CHOUARD, P. Botanic gardens and their scope (F.).
 HÖFKER, H. Geographic and ecological gardens (G.).
 CHITTENDEN, F. J. The type of garden realized at Wisley.
 PIEDALLU, A. Explosives and the cultivation of trees (F.).

432. INTERNATIONAL INSTITUTE OF AGRICULTURE. 31 : 63
International Year Book of Agricultural Statistics, 1931.
 Treves, Treccani, Tumminelli, S. A. 32 Via Michelangelo Caetani, Rome (115)
 1932, pp. 782, price 90 liras. [Received July, 1933.—ED.]

The statistics deal with the agricultural production, imports and exports of all countries individually under the following main heads:—(1) Territorial area and population. (2) Apportionment of areas to agricultural production and numbers of livestock. (3) Area, production and yield per hectare of principal crops. (4) Numbers of the principal species of livestock and poultry. (5) International trade. (6) Stocks of cereals. (7) Prices of various agricultural products. (8) Fertilizers and chemical products useful in agriculture. (9) Distribution of agricultural holdings according to size and mode of tenure.—The principal fruits, tea, coffee, rubber, etc., are dealt with, where grown, under the appropriate sections.

* (F.) or (G.) after a paper signifies that it is in French or German. Selected papers will be abstracted in the next issue of *H.A.*

433. INTERNATIONAL INSTITUTE OF AGRICULTURE.

31 : 63

The agricultural situation in 1931-32.

Printing office of the Chamber of Deputies, Rome, 1933, pp. 536, price 25 liras.

This is an economic commentary on the "International Year Book of Agricultural Statistics" noticed in Abstract No. 432 of this issue. The commentary includes a general review of the course of the agricultural depression of 1932 and notes for each country on market conditions of its various crops including fruit crops, an account of the measures of farm relief taken by its Government and by voluntary organizations in the interests of the producers, and finally an account of its economic conditions of agriculture.

434. MUTH, F.

634.1/8

Bericht der Lehr- und Forschungsanstalt für Wein- Obst- und Gartenbau zu Geisenheim a. Rh. für 1931/32. Report of the Geisenheim Horticultural Institute for 1931/32. Paul Parey, Berlin, 1933, pp. 33.

The research projects undertaken by the different departments of the Institute are very shortly discussed. Dr. Muth's own experiments include:—successful artificial manure trials; the testing of the influence of nicotine, soft soap and tobacco extract on the ripening of grapes, no deleterious effects being found when proper care was taken in application; examination of hydrangea petal greening. This would appear to be due to a virus, attempts to induce it by intensive treatment with nitrogenous or aluminium salts being unsuccessful. The plant pathology department reports work on *Graphium ulmi* and the incidence of certain vegetable, flower and fruit pests and diseases, the testing of proprietary sprays and other control work. Work in the physiological department indicated that the apple pollen variety had no effect on the size, shape or colour of seed, or on the shape or colour of the fruit, though it did apparently affect the size of the fruit of the pollinated variety. The pollinated varieties were Pineapple Pippin, Graue Herbstrenette, White Winter Calvill and Canada Pippin. Artificial lighting with acetylene lamps in the greenhouse of lilac, sweet peas, freesias, hydrangeas, cinerarias, roses and strawberries was not successful. Possibly higher powered lamps might have succeeded, but these could not have been used economically. Wine ferments are receiving considerable attention. Claims made for Lipkin's process that by it natural wine can be differentiated from wine to which sugar has been added were not substantiated. Soil investigations include work on the importance of the following:— P_2O_5 in heavy calcareous vineyard soils, soil sickness and vine degeneration; soil reaction and horticultural plants in general. The departments dealing with fruit and vegetable products give short notes on investigations with regard to a number of problems connected with unfermented fruit juices, pectins, etc. Finally the vine breeding investigations are mentioned.

435. IMPERIA.

634.63

Annali dell' Istituto sperimentale per l'olivicoltura e l'oleificio di Imperia.

(Annals of the Imperia Research Station for olives and oil extraction.)

Volume 4, July, 1931 to December, 1932, pp. 270.

This is the report of one of the few research stations devoted entirely to the study of the olive and olive oil extraction. Problems dealt with in their different phases in the separate articles include the following:—Industrial oil extraction in Spain—Olive fly control—Renovation of old groves—Different methods and devices for oil extraction—Oil extraction from dried olives—Centrifuging olive musts—Preservation of olives in SO_2 —Chemical composition of olive oil and its determination.

